Original Article

Association Between Vitamin D, Calcium, Alkaline Phosphatase and Lipid Profile in Male and Female Subjects

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ABSTRACT

Objective: To determine the association between vitamin D, Calcium, alkaline phosphatase and lipid profile in male and female subjects.

Study Design: Cross-Sectional Study

Place and Duration of Study: This study was conducted at the Darul-Sehat Hospital Karachi's outpatient department from July 2018 to January 2019 for a period of seven months.

Materials and Methods: A total of 100 male and female individuals between the ages of 40 and 60 were chosen. Vitamin D, lipid profile, alkaline phosphatase, and calcium levels were all tested in the individuals' blood. The participants were divided into two groups: those who had adequate vitamin D levels and those who were deficient in vitamin D.

Results: Total cholesterol and TGs were found to be higher in both male and female participants. Female subjects had lower LDL cholesterol, whereas male subjects had considerably higher LDL cholesterol. Serum HDL cholesterol, on the other hand, was exclusively elevated in female individuals while remaining unaltered in male respondents. Only female individuals had considerably higher serum calcium levels. Both male and female individuals had significantly higher serum alkaline phosphatase levels.

Conclusion: Despite the fact that there is a negative correlation between 25 (OH) D levels and lipid profile in both male and female participants, serum vitamin D has been reported as a putative cardio-protective vitamin in female subjects via boosting HDL-C. Alkaline phosphatase levels were higher in both genders.

Key Words: Vitamin D, Calcium, Alkaline Phosphatase, Lipid Profile

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INTRODUCTION

Health, development and maintenance of bone require adequate amounts of vitamin D. Vitamin D deficiency has been linked to the development of osteoporosis as a result of secondary hyperparathyroidism, which causes calcium to be mobilized out of bones, increasing the risk of fall-related fractures.[1]

Vitamin D deficiency is also associated with lack of sun exposure in humans.

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Vitamin D-fortified foods and naturally occurring foods are usually insufficient to meet a child's or adult's vitamin D requirements. [2] Inadequate vitamin D levels have also been related to a higher risk of cancer, autoimmune disease, diabetes, hypertension, and infectious disease.[3, 4] Many factors contribute to vitamin D insufficiency, including changes in lifestyle such as the use of sunscreen, the adoption of covered clothes according to cultural standards, obesity, and the global environment.[5]

Skin exposure to sunshine is the primary source of vitamin D in humans. After absorbing sunlight, 7-dehydrocholesterol is converted to pro-vitamin D in the skin, which is then hydroxylated by hydroxylases in the liver and kidney into 25(OH) D and 1, 25-dihydroxyvitamin D3 (an active form). Vitamin D's primary role is to regulate calcium and bone metabolism. An integrated hormonal system that regulates calcium movement from the gut, kidneys, and bones regulates serum calcium levels. Calcium metabolism is facilitated by the parathyroid hormone PTH and the PTH receptor (PTHR), 1, 25 (OH) 2D and vitamin D receptor (VDR), calcitonin, ionised serum calcium, and the calcium-sensitive receptor (CaRare).[6] Other roles include modulating immunological

function, anti-inflammatory activity, regulating the rennin-angiotensin system, and decreasing insulin resistance.[7] Vitamin D insufficiency may play a role in the onset of endocrine-metabolic disorder.[8] Vitamin D insufficiency is thought to be linked to cardiovascular health issues. In patients with cardiovascular disease, vitamin D insufficiency has been related to an increased risk of death.[9] The relationship between vitamin D status and blood lipid levels may differ between men and women. Within each gender, more females than males were vitamin D deficient.[10]

The objective of present study was to determine the association between Vitamin D, Calcium, Alkaline Phosphatase and Lipid Profile in male and female patient attending outpatient department of Darul-Sehat Hospital Karachi.

MATERIALS AND METHODS

From July 2018 to January 2019, a cross-sectional study was conducted at Darul-Sehat Hospital in Karachi, Pakistan, in the outpatient department (OPD). A total of 200 healthy people, 100 males and 100 females, between the ages of 40 and 60, were chosen. They were divided into two groups: one with low vitamin D levels and the other with normal vitamin D levels. Participants with hyperlipidemia, a family history of hyperlipidemia, diabetes, chronic metabolic disorders such chronic renal failure and chronic liver failure, morbid obesity (BMI > 30), cigarette smokers, and those using vitamin D supplements or statin medication were all excluded from the study. Fasting blood samples were taken and maintained for estimate after receiving written consent and a medical history. Kit technique (Randox®, Private Ltd) was used to calculate serum cholesterol, triglycerides, HDL-C, LDL-C, calcium, and alkaline phosphatase. ELISA was used to determine vitamin D levels (Enzyme linked Immunosorbant Assay).

The ethical committees of Darul Sehat Hospital and Liaquat College of Medicine and Dentistry Karachi gave their clearance. SPSS version 24 was used for the statistical analysis (IBM corp, USA). The Student's t-test was used to determine the relationship between serum vitamin D, lipid profile, calcium, and alkaline phosphatase. Significant was defined as a p-value of less than 0.05.

RESULTS

The relationship between vitamin D and lipid profile in male participants is shown in Table I. Between participants with low vitamin D levels and those with normal vitamin D levels, there was a significant difference in vitamin D levels ($P<0.05$). Total and HDL cholesterol levels were not significantly different between the two groups, however LDL cholesterol levels in vitamin D deficient groups were significantly higher ($P<0.05$) than in vitamin D normal groups. There was a significant difference ($P<0.01$) in triglyceride levels between the two groups, with the vitamin D deficient group having greater levels than the vitamin D normal group.

The relationship between vitamin D and lipid profile in female participants is shown in Table I. Between participants with low vitamin D levels and those with normal vitamin D levels, there was a significant difference in vitamin D levels ($P<0.05$). The vitamin D deficient group had considerably higher total cholesterol when total cholesterol was compared between the two groups ($P<0.01$). When compared to the normal vitamin D group, LDL-cholesterol was considerably higher in the vitamin D deficient group ($P<0.01$). When the HDL-cholesterol levels of the two groups were examined, there was no significant difference. There was a significant difference ($P<0.01$) in triglyceride levels between the two groups, with the vitamin D deficient group having greater levels than the vitamin D normal group.

Table No.1: Effects of Vitamin D on Lipid Profile in Male & Female

Laboratory Profile	25 (OH) D <20 ng/ml (n=50)	25 (OH) D ≥20 ng/ml (n=50)	p-value
	Mean (SD)	Mean (SD)	
MALES			
VITAMIN D (ng/ml)	15.6 ± 2.3	32.0 ± 3.0	0.05
TC (mg/ml)	170.6 ± 2.5	172.0 ± 2.6	N.S
LDL-C (mg/ml)	153.0 ± 3.5	113 ± 3.9	0.01
HDL-C (mg/ml)	36.0 ± 5.0	39.6 ± 4.1	N.S
TG (mg/ml)	257.0 ± 4.5	168.5 ± 4.3	0.01
FEMALES			
VITAMIN D (ng/ml)	15.5 ± 1.3	30.0 ± 1.5	< 0.01
TC (mg/ml)	251.2 ± 4.1	180.2 ± 3.6	< 0.01
LDL-C (mg/ml)	197.5 ± 4.3	143.7 ± 5.1	< 0.05
HDL-C (mg/ml)	42.4 ± 4.0	40.3 ± 5.1	N.S
TG (mg/ml)	214.0 ± 4.1	148.5 ± 5.0	< 0.01

The effects of vitamin D on calcium in male participants are shown in Figure 1. The results demonstrate that in the normal vitamin D group, calcium levels were higher but within normal ranges, whereas in the vitamin D deficient group, calcium levels were lower. The effects of vitamin D on calcium in female participants are shown in Figure 2. It reveals that in the normal vitamin D group, calcium levels were higher but within normal ranges, whereas in the vitamin D deficient group, calcium levels were lower. The effects of vitamin D on Alkaline Phosphatase in male individuals are shown in Figure 1. When comparing the

vitamin D deficiency group to the vitamin D normal group, alkaline phosphatase was greater in the vitamin D deficient group. The effects of vitamin D on Alkaline Phosphatase in female participants are depicted in Figure II. When comparing the vitamin D deficient group to the vitamin D normal group, alkaline phosphatase was found to be greater.

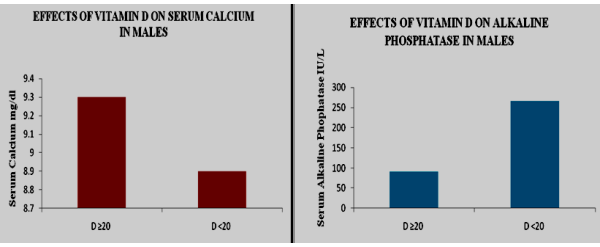

Figure No.1 Effects of Vitamin D on Calcium & Alkaline Phosphatase in Male Subjects

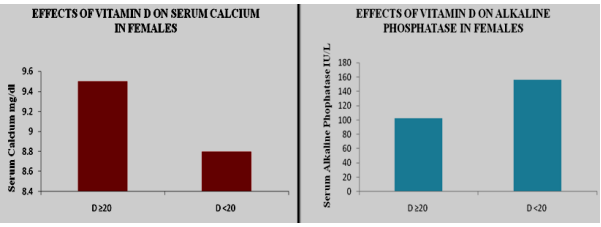

Figure No.2: Effects of Vitamin D on Calcium & Alkaline Phosphatase in Female Subjects

DISCUSSION

Hyperlipidemia has been associated to an increase in mortality and morbidity, leading to cardiovascular disease; regulating lipid levels with vitamin D replacement would be an intriguing area to follow. Vitamin D deficiency can be caused by a variety of factors in our society, including a high-fiber diet that inhibits fat and fat-soluble vitamin absorption, a low intake of fish, which is a good source of vitamin D, and limited sun exposure due to a variety of factors, including living in a high-rise building with no exposure to sunlight, wearing a burka, dark skin with high melanin, which reduces the skin's ability to produce vitamin D, and diseases which limits absorption of vitamin D and many other factors.

In our research, we discovered a link between vitamin D and serum lipid levels in both male and female participants. Vitamin D deficiency has been linked to elevated lipid levels, which are a risk factor for cardiovascular disease. Vitamin D deprivation raised total cholesterol, triglycerides, and LDL-C in both male and female individuals, but did not affect serum HDL-C in either group.

Vitamin D insufficiency has been linked to elevated lipid levels in numerous studies. [11, 12] Vitamin D has both direct and indirect effects on lipid profile adjustment, according to Wang et al, and the effect of vitamin D on decreasing blood triglyceride levels could be related to a regulatory mechanism that stimulates lipoprotein lipase activity in adiposity. [13] As lipoproteins amass in the arterial wall, platelets and monocytes anchor to the intima layer. Monocytes that have been internalized form macrophages, which eventually become foam cells. The lipids are then deposited intracellularly and in the ECM, causing the characteristic atherosclerotic plaque to develop. [14] Vitamin D controls triglyceride metabolism by promoting the production of VLDL cholesterol receptors in some cell types. [15] Hypertriglyceridemia is linked to low vitamin D levels, according to other studies. [16,17] Another study found that greater calcium uptake by the intestines, which is caused by higher vitamin D levels in the blood, lowers triglyceride levels in the blood. Calcium deficiency inhibits triglyceride production and release in the liver. [18] TG levels can be reduced by lowering PTH levels. [19] Due to the fact that both cholesterol and vitamin D share a same mechanism for production, a defective LDL-receptor reduces cholesterol uptake, which lowers vitamin D levels. [20] A 14-year longitudinal study showed a correlation between Vitamin D and lipid levels, as well as a link between low levels of vitamin D and TGs, which can contribute to high death rates. [21] Vitamin D levels were linked to insulin resistance, metabolic syndrome, hypertriglyceridemia, obesity, and hypertension in a study that looked at the link between vitamin D levels, metabolic syndrome, and subclinical atherosclerosis. High vitamin D levels were found to lower the risk of metabolic syndrome, while low vitamin D levels were linked to insulin resistance, metabolic syndrome, hypertriglyceridemia, obesity, and hypertension. [22]

The connection between calcium intake, circulating calcium levels, hormones, and bone condition is regulated by homeostatic mechanisms, with parathyroid hormone (PTH) and vitamin D being the most important contributors.[23,24] Alkaline is a term used to describe a substance that is alkaline in nature. Phosphatase levels were higher in both genders, possibly as a result of high PTH levels. When vitamin D levels are low, PTH levels rise, and when vitamin D levels are high, PTH levels fall. Increased PTH causes an increase in TGs due to sluggish lipolytic activity, which removes them from the peripheral; this is how vitamin D impacts PTH levels, which influences blood TG levels. [25]

The study's cross-sectional methodology and the inability to determine causation from the discovered associations were other drawbacks. To fully comprehend the relationship between vitamin D and blood lipid profiles, large randomized controlled trials are required.

CONCLUSION

Although there is a negative link between 25 (OH) D levels and lipid profile in both male and female

participants, serum vitamin D has been described as a putative cardio-protective vitamin by raising HDL-C in female subjects. Both genders had higher amounts of alkaline phosphatase.

Author's Contribution:

Concept & Design of Study:	Shabana Saeed, Farhan Jaleel, Sara Altamash
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Final Approval of version:	Shabana Saeed, Farhan Jaleel, Sara Altamash

Conflict of Interest: The study has no conflict of interest to declare by any author.

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