ISSN: 2319-8753

International Journal of Innovative Research in

Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

Hypovitaminosis D:Association With Altered Blood Lipid Profile

Reshma K[1], AlapChristy[2], Sudha K[3]*

Associate Professor, Department of Biochemistry, KMC, Mangalore, ManipalUniversity, Karnataka, India[1]

PG student,Department of Biochemistry, KMC, Mangalore, Manipal University, Karnataka, India[2,]

Associate Professor, Department of Biochemistry, KMC, Mangalore, ManipalUniversity,Karnataka, India[3]

*Corresponding Author

Abstract: Although India is a country full of sunshine, it is reported that 80% of healthy Indians are deprived of the sunshine vitamin ,vitamin D. Some of the risk factors for the same include non white ethnicity, obesity, less outdoor activity and age. Vitamin D status has been correlated with PTH status, blood pressure, Type I & II diabetes mellitus in humans .Reports on studies linking vitamin D with dyslipidemia amongst Indians is scarce. Since vitamin receptor and 1α hydroxylase gene is reported to be present in human adipocytes, white adipose tissue may be a direct target of Vitamin D. The present study aims at establishing a correlation between vitamin D status and lipid profile in the coastal belt of South India where dyslipidemia is prevalent.A total of 76 subjects in the age group 20-50 years were included in the study and categorized under 2 groups-Group1(n=62) had suboptimal levels of vitamin D(<29 ng/ml)and group 2(n=14) had optimal levels of vitamin D(>29 ng/ml).Lipid profile was analysed in both groups. Group 1 had higher levels of cholesterol (p=0.05) and triglyceride levels (p=0.049) as compared to Group 2 although mean values in both groups were in the normal range.Accordingly, this group showed significantly higher levels of VLDL and LDL. Pearson correlation studies of vitamin D with lipid profile in both genders showed a negative correlation in all parameters while significant correlation was observed in males with respect to total cholesterol,LDL and total cholesterol to HDL ratio. In females vitaminD deficiency influenced only serum cholesterol levels significantly.Based on these findings, it is imperative to state that suboptimal levels of vitamin D may be implicated in the development of dyslipidemia,especially in male population.

Key Words: Vitamin D, lipoproteins, lipid profile

I.INTRODUCTION

Vitamin D deficiency is currently being considered as a worldwide problem.Some of the human races who have been reported to show a high incidence of hypovitaminosis D include US paediatric population[1],Black Americans[2],South Indian women[3],Northern European Russians[4]. VitaminD receptors arereported to be present in most of the tissues within the human body based on recent research[5].Therefore extraskeletal effects of vitaminD seems to be more challenging in the current scenario. Thus this vitamin has been correlated with parathormone status[6],Blood pressure[7],Diabetes mellitus[8],obesity[9],and immunity status[10] and has been stated to be a causative factor in most of these disorders.Since the expression of both vitaminD receptor and 25(OH)vitamin D 1 αhydroxylase (CYP27B1) genes have been shown in murine and human adipocytes[11],white adipose tissue may be a direct target for vitamin D.It is therefore crucial to relate vitaminD status with lipid metabolism, emphasising on the fact that dyslipidaemia is the underlying metabolic cause for cardiovascular diseases.The present work aims at establishing a correlation between vitamin D status and fasting lipid profile in the coastal belt of SouthIndia,where there is abundant sunlight all through the year,and dyslipidaemiabeing rampant in this part of the country.

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

II.MATERIALS AND METHODS

This crosssectional study cohort consisted of a total of 76 subjects in the age group 25-55 years, of which 46 were males and 30 were females.Those subjects who were non hospitalized and apparently normalhaving no history of cardiovascular ,renal or any other systemic diseases, were randomly selected for the study.

Fasting lipid profile was validated with the use of standard autoanalyser methods on P-E 800,RocheAnalyser.The blood samples were analysed for triglycerides,cholesteroland HDL cholesterol(after precipitating with magnesium and phosphotungstate).LDL cholesterol was calculated using Friedwalds formula.Vitamin D assay was performed based on the principle of electrochemiluminiscence,on COBAS e-411 autoanalyser.

Statistical Analysis: VitaminD levels below 29ng/ml was considered to be suboptimal (group 1) and values above 29ng/ml(group2) optimal. All the statistical analysis were done based on IBMM SPSS software version 20.Since the distribution of blood values were normal,Pearson correlation studies were performed to relate vitamin D levels with lipid profile,in both groups.Student t test was used to compare the mean values of the parameters in the 2 groups and p=0.05 or less than 0.05 were considered to be significant.

III.RESULTS

Suboptimal levels of vitamin D was significantly associated with higher blood levels of cholesterol (p=0.05) and triglycerides(p=0.049).Accordingly this group showed a significant increase in VLDL and LDL, although all values of lipid profile reported were within normal limits (Table 1,2,3). Pearson correlation studies of vitamin D with lipid profile in both genders(Table 6) showed a negative correlation in all parameters of which total cholesterol and triglycerides were significant, while significant correlation was observed in males(Table 4) between vitamin D, total cholesterol , LDL, and total cholesterol to HDL ratio and a significant negative correlation only with respect to total cholesterol and vitamin D levels was observed in females(Table 5).

Table1 : Serum Lipid profile values in Group1(vitD< 29ng/ml) and Group2 (vitD> 29ng/ml)Values are Mean± S.D (n=62)

	Group 1	Group 2
Lipid Profile	**Units(mg/dl)**	**Units(mg/dl)**
Triglycerides	153.64±76*	111.57±38
Total cholesterol	198.12±40.75*	175.35+39
VLDL	29.48±13.6*	22.78±7.6
LDL	119.61±41.5*	101.82±27.5
HDL	47.41± 11.18	47.22± 14.37
Total Cholesterol/HDL ratio	4.36±1.3*	3.76±0.94

*p<0.05:significant between group1 and group 2

Table2:Serum Lipid profile and vitaminD values in females(mean±S.D)(n=36)

Vit D(ng/ml)	22.13 ± 14.29
TC(mg/dl)	188.65 ± 28.25
TG(mg/dl)	141.13 ± 66.64
HDL(mg/dl)	51.30 ± 11.998
LDL(mg/dl)	114.71 ± 25.70
VLDL(mg/dl)	27.99 ± 13.24
Total Cholesterol/HDL ratio	3.89 ± 0 .92

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

Table 3: Serum Lipid profile and vitDvalues in males (mean± SD) ,(n=40)

Vit D(ng/ml)	22.56±12.03
TC (mg/dl)	199.33±53.83
TG(mg/dl)	148.60±79.67
HDL(mg/dl)	45.74±9.9
LDL(mg/dl)	123.11±49.21
VLDL(mg/dl)	29.40±14.33
Total Cholesterol/HDL ratio	4.54± 1.58

Table 4:Correlation ofSerum Lipid profile with VitD in males (n=46);r values

	Total cholesterol	Triglycerides	VLDL	HDL	LDL	Total cholesterol/HDL
Vit D	-.405	-.171	-.237	-.104	-.420	-.304
P value	0.013*	>0.05	>0.05	>0.05	0.01*	0.05*

*p<0.05:significant

Table 5:Correlation of Serum Lipid profile with Vit D in females (n=30); r values

	Total cholesterol	Triglycerides	VLDL	HDL	LDL	Total cholesterol/HDL
Vit D	-.365	-.150	-.159	-.029	-.019	-.083
P value	0.026*	>0.05	>0.05	>0.05	>0.05	>0.05

*p<0.05:significant

Table 6:Correlation of Serum Lipid profile with VitD in both genders(n=76);r values

	Total cholesterol	Triglycerides	VLDL	HDL	LDL	Total cholesterol/HDL
Vit D	-.281	-.222	-.192	.031	-.144	-.163
P value	0.015*	0.05*	>0.05	>0.05	>0.05	>0.05

*p<0.05:significant

IV.DISCUSSION

Hypovitaminosis D has been reported in several races across the world to date[12],due to several reasons described earlier.We report that vitamin D deficiency is prevalent in South Indian population as 82% of the subjects enrolled in the study had suboptimal levels of vitamin D.

HypovitaminosisD has been associated with increased total cholesterol and reduced apoA-1 in Belgian men[13].A significant association between serum 25(OH)D and lipid profile such as TG and HDL were observed in Chinese population[14]Inverse correlations between vitamin D and lipids has been reported in Canadian subjects [15].Total body fat

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

was inversely associatedwith serum 25-hydroxyvitaminD in both sexes in a population based study by Snidjeretal[16]. Earlier reports on women belonging to different races showed that there was no correlation between lipids and vitaminD status in Asian women[17].Our observations are in agreement with these findings which indicates that ethnicity may play a prominent role in body metabolism.

Further dyslipidemia and proinflammatory states are the coexisting factors in metabolic syndrome which is often accompanied by insulin resistance.Several reports published to date indicate the prevalence of vitamin D deficiency in obesity[18] and insulin resistance[19]. Certain studies have stated that vitamin D inhibits production of proinflammatory cytokines like IL-1,IL-2,IL-6,TNF-α via the vitamin D receptor expressed in monocytes and activated lymphocytes[20],probably explaining the role of vitamin D in insulin resistance and obesity. Moreover vitamin D is required for the regulation of appropriate levels of apo A1,a component of HDL [21] and regulation of lipoprotein lipase activity[22]thus influencing triglyceride levels in the blood. In support to this concept ,vitamin D supplementation (25µg/d) in obese women showed a significant increase in HDL cholesterol and Apo A1 and a decrease in body fat[23].

It is also postulated that intracellular calcium in adipocytes favourlipogenesis in adipose tissue [24]. Thus deficiency of vitamin D may decrease the uptake of calcium by adipose tissue,initiating lipolysiselevating circulating levels of free fatty acids,increasing hepatic synthesis of VLDL and LDL.However to date there is no availability of authentic or concrete l proof to state vitamin D as a causative factor in the development of dyslipidemia.

VDR gene polymorphism studies may overcome the paucity of evidences to support the involvement of vitamin D in influencing blood lipids, in future studies.Vitamin D supplementation may then reinforce survival benefits in patients with dyslipidaemia.

V.CONCLUSION

Based on these findings, it is imperative to state that suboptimal levels of vitamin D may be implicated in the development of dyslipidemia,especially in male population.

REFERENCES

[1] Michal L Melamed,"Low levels of 25- hydroxyvitamin D in the pediatric populations: prevalence and clinical outcomes",Ped Health. Vol. 4(1),pp89–97, 2010

[2] Reis, J.P., von Mühlen, D., Miller, E.R.,Michos,E.D.andAppel, L.J.,"Vitamin D status and cardiometabolic risk factors in the United States adolescent population".Pediatrics,vol.124(3),pp371-9, 2009

[3]Harinarayan,C.V.and Joshi,S.R.,"Vitamin D status in India-Its implications and remedial measures".J Assoc Physicians India.Vol.57,pp40-48,2009

[4] Potolitsyna, N. N.,Bojko E. R.and Orr, P."Lipid metabolism indices and their correlation with vitamin D levels in indigenous populations of northern European Russia". Human Physiology, vol. 37 (2), pp 184-187,2011

[5] Holick, M.F.," Vitamin D: a d-lightful solution for health". J Investig Med,Vol.59(6), pp872-80,2011.

[6] LaufeySteingrimsdottir, OrvarGunnarsson,Olafur S. Indridason, LeifurFranzson, Gunnar Sigurdsson, "Relationship Between Serum Parathyroid Hormone Levels, Vitamin D Sufficiency, and Calcium Intake",JAMA,vol.294(18), pp2336-2341. 2005

[7] Forman, J.P.,Bisohoff-Ferrari, H.A.,Willet WC et al.,"Vitamin D intake and risk of incident hypertension:results from three large prospective cohort studies", Hypertension,vol.46, pp676-682,2005

[8] GoswamiR., Mishra,S.K.,and. Kochupillai,N.,"Prevalence & potential significance of vitamin D deficiency inAsian Indians".Indian J Med Res,vol.127,pp 229-238, 2008

[9] Buffington, C., Walker, B., Cowan,G.S.andJr, Scruggs, D."Vitamin D deficiency in the morbidly obese".ObesSurg.,vol.3,pp421–424,1993

[10] Muller, K., Odum,N.,andBendtzen. K.," 1,25-dihydroxyvitamin D3 selectively reduces interleukin-2 levels and proliferation of human T cell lines in vitro". Immunol Lett.vol.35,pp177–182,1993

[11] Cherlyn Ding,Dan Gao,John Wilding,Paul Trayhum, Chen Bing .British Journal of nutrition,vol. 108(11), pp1915-1923,2012

[12] Ligia, A., Martini, P., Richard, J., Wood, PhD."Vitamin D Status and the Metabolic Syndrome".Nutrition Reviews,vol.64(11), pp 479-486,2006

[13] Auwerx, J., Bouillon, R., Kesteloot, H.," Relation between 25-hydroxyvitamin D3, apolipoprotein A-I,and high density lipoprotein cholesterol".ArteriosclerThromb,vol. 12(6),pp671-4,1992

[14] Xiao Yin, Qiang Sun, Xiuping Zhang, Yong Lu, Chao Sun, Ying CuiandShaolianWang."Serum 25(OH)D is inversely associated with metabolic syndrome risk profile among urbanmiddle-aged Chinese population". Nutrition Journal ,vol.11,pp68-70 ,2012,

[15] BibianaGarcia.Bailo,Lauro A Da Costa,AlaaBadawi."Plasma vitamin and biomarkers ofcardiometabolic disease risk in adult Canadians", Prev Chronic Dis,vol.10,pp91-93, 2013

[16] Snidjer,M.B.,van Dam ,R.M.,Visser, M.,etal."Adiposity in relation to vitamin status and parathyroidhormone levels: a population based study in older men and women".JClinEndocrinol Metab,vol.90,pp4119-4123, 2005

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

[17] Susan Lanham-New1, Puikwan Lee, Max Wong, Carol Sui, Sue Starkey, David Lovell,etal,"Association between dietary vitamin D intake and serum lipid profiles in Asian and CaucasianUK women: preliminary results from the VitaminD, Food Intake, Nutrition and Exposure toSunlight in Southern England (D-FINES) Study". Proceedings of the Nutrition Society (2008)

[18]Rosenstreich,S.J.,Rich, C., VolwilerW.,"Deposition in and release of vitamin D3 from bodyfat:evidence for a storage site in rat",.J Clin Invest.,vol.50, pp679-687,1971

[19]Chiu,K. C., Chu,A. V, Go, L. W. andSaad,M. F.,"Hypovitaminosis D is associated with insulin resistance and β cell dysfunction". American Journal of Clinical Nutrition , vol.79 (5) ,pp 820–825,2004

[20]. Muller, K., Odum,N.andBendtzen, K.," 1,25-dihydroxyvitaminD3 selectively reduces interleukin-2levels andproliferation of human T cell lines in vitro". ImmunolLett,vol.35,pp177–182, 1993

[21]Auwerx,. J., Bouillon, R.,andKesteloot,H.,"Relation between 25-hydroxyvitamin D3,apolipoprotein A-I, and high density lipoprotein cholesterol". ArteriosclerThrombVascBiol,vol. 12, pp671-674,1992

[22].Yifan Huang, XiaoxiaLi,MaoqingWang,HuaNing,Lima A etal."Lipoprotein lipase links vitaminD,insulinresistance,and type 2 diabetes: a cross sectional epidemiological study".Cardiovascular Diabetology,vol.12,pp17 -20, 2013

[23]. Salehpour, A., Shidfar, F., Hosseinpanah, F., Vafa, M., Razaghi, M., Hoshiarrad, A., Gohari, M.," Vitamin D3 and the risk of CVD in overweight and obese women: a randomised controlled trial". Br J Nutr, vol. 108(10), pp1866-73, 2012

[24]. MélanieJacqmain, Eric Doucet, Jean-Pierre Després, Claude Bouchard, Angelo Tremblay." Calcium intake, body composition, and lipoprotein-lipid concentrations in adults". Am J ClinNutr., vol. 77, pp1448-1452,2003