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PREVALENCE OF VITAMIN D AND SERUM CALCIUM, PHOSPHORUS AND ALKALINE PHOSPHATASE IN PEDIATRIC POPULATION OF KANCHEEPURAM DISTRICT, TAMILNADU.

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ABSTRACT

Vitamin D deficiency has become the emerging threat to modern medicine. Globally, around 29-100% of children and adolescents have vitamin D deficiency.The objective of current study is to find out the prevalence of vitamin D deficiency and calcium, phosphorus and alkaline phosphatase in pediatric population of Kancheepuram District, Tamilnadu. Healthy children of both sexes between the age of 1-17 living in and around Potheri village was included. Total of 100 subjects, out of which 50 males and 50 females were recruited. 2 ml of the blood was drawn and serum levels of vitamin D, calcium, phosphorus and alkaline phosphatase were estimated. Prevalence of Vitamin D deficiency in healthy children was 59%, insufficiency and normal levels were 36% and 5% respectively. Prevalence of Vitamin D deficiency is alarming in the Kancheepuram district and government should intervene and create awareness to address this public health problem on a priority basis.

KEY WORDS:Vitamin D, prevalence,deficiency,calcium, phosphorus, alkaline phosphatase

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INTRODUCTION

Vitamin D deficiency has become the emerging threat to modern medicine.It has become a herculean task to combat this pandemic.Once upon a time, hormone restricted its role as building block of bone, it has gained so much importance in the recent past, because of its association with plenty of diseases like cancers(colon, breast and prostate), chronic inflammatory and auto immune diseases (Type 1 diabetes mellitus, inflammatory bowel diseases and multiple sclerosis) and metabolic disorders[1,2]. Conventional action of vitamin D is to absorb calcium and phosphorus from gut, but now evolved its role as an immuno modulator. Deficiency of this vitamin leads to rickets in children and osteomalacia in adults[3,4].Major source of vitamin D is UV sunlight of wave length 280-315nm.Dietary sources of vitamin D are oily fish, dairy products, egg and meat. Globally, around 29-100% of children and adolescents have become victims of Vitamin D deficiency[5,6].In India, such studies related to prevalence of vitamin D status in children are limited.The objective of current study is to determine the prevalence of vitamin D deficiency and serum calcium, phosphorus and alkaline phosphatase levels in pediatric population of Kancheepuram District, Tamilnadu.

MATERIALS AND METHODS

Healthy children of both sexes between the age of 1-17 living in and around Potheri village were included. Total of 100 subjects, out of which 50 males and 50 females were recruited.Institutional ethical committee clearance was obtained prior to the study. Written informed consent was got from every subject. Demographic data such as height, weight, BMI & other details like diet, sun light exposure, socioeconomic status, skin color were collected using a preformed proforma.2 ml of the venous blood was drawn and serum levels of vitamin D, calcium, phosphorus and alkaline phosphatase were estimated.

1.Estimation of Serum Vitamin D:Method used was chemiluminescence micro particle assay.Architect 25- OH Vitamin D kit was loaded in Architect i system to estimate serum Vitamin D levels.In this method, levels below 20ng/ml is considered as deficiency, 20-30 ng/ml is insufficiency and levels between 30-80ng/ml is optimum.

2.Estimation of Serum Calcium : This was done by using modified O-cresolphthalein Complexone method using Erba Mannheim Calcium estimation kit using UV spectrophotometer. Normal values of calcium using this kit is 8.4-10.4mg/dl.

3.Estimation of Serum Phosphorus:This was done by molybdate UV method using Liquimax Phosphorus –SLR kit purchased from Avecon Healthcare Pvt Ltd. UV spectrophotometer was used for estimation. In this method, normal values of serum Phosphorus is in a range of 2.4-5.0mg/dl.

4.Estimation of serum alkaline phosphatase:This was done quantitatively by DEA buffer/DGKC method using Liquimax alkaline phosphatase purchased from Avecon Healthcare Pvt Ltd. Normal range of alkaline phosphatase ranges from 80-315.

STATISTICAL ANALYSIS

Analysis was performed using SPSS version 16.Continuous variables were expressed as mean ± SD. Discrete variables were expressed as frequency (percentage). Pearson's correlation test was used to find out the significant correlation between vitamin D and the study variables. A p value of 0.05 was considered as significant. Fisher's exact test was used to test the association between vitamin D with discrete study variables. Correlation was significant at 0.05 level. Significant difference between gender was analysed using independent t test and results were considered statistically significant if the p value was less than 0.05. Association of Gender with discrete variables was performed using Pearson Chi square test and Fisher's Exact test. In this test, p value of less than 0.05 considered as significant.

RESULTS

Prevalence of vitamin D deficiency in the healthy children was 59%, insufficiency and normal levels were 36% and 5% respectively. Sub optimum levels of vitamin D was seen in

95% of the total population. Among male paediatric population,52%,38% and 10% were deficient, insufficient and had normal levels of serum vitamin D respectively. Among girls,66% and 34% had deficiency, insufficieny and none had optimum vitamin D levels. Sub optimal levels of Vitamin D was 100% in girls compared to 90% in boys.(Table 1)

Table 1
Basic Characteristics

Variable		Total n (%)	Male n (%)	Female n (%)
Vitamin D Status	Deficiency	59 (59)	26(52)	33(66)
	Insufficient	36 (36)	19(38)	17(34)
	Optimum	5 (5)	5(10)	0
Milk consumption/day	0	14 (14)	8(16)	6(12)
	0.5	22 (22)	11(22)	11(22)
	1	39	17(34)	22(44)
	2	25	14(28)	11(22)
Egg consumption/week	1	50	21(42)	29(58)
	2	37	19(38)	18(36)
	3	13	10(18)	3(6)
Non veg consumption/week	1	65	27(54)	38(76)
	>2	35	23(46)	12(24)
Living condition	Concrete	40	24(48)	16(32)
	Hut	7	4(8)	3(6)
	Sheet	53	22(44)	31(62)
Religion	Christian	5	5(10)	0
	Hindu	90	42(84)	48(96)
	Muslim	5	3(6)	2(4)
School	Government	58	25(50)	33(66)
	Matriculation	42	25(50)	17(34)
Diet	Mixed	100	50(100)	50(100)
BMI	N	68	40(80)	28(56)
	UW	32	10(20)	22(44)

Table 2
Descriptive statistics

Variable	Mean±SD –Total	Mean±SD –Male	Mean±SD –Female
Age	9.10±3.36	8.65±3.51	9.55±3.16
BMI	15.07±1.76	15.15±1.52	14.99±1.99
Socio economic status	101.85±6355.49	110.10±8294.63	936.00±3379.17
Sun light exposure	66.45±41.89	71.80±46.43	61.10±36.48
Vitamin D level	17.44±8.38	19.06±8.51	15.81±8.01
Serum calcium	9.56±1.26	9.47±1.18	9.66±1.34
Serum phosphorus	4.73±1.14	4.95±1.19	4.51±1.06
Serum alkaline phosphatase	128.33±72.96	114.06±72.48	142.61±71.32

Correlation of Vitamin D with study variables

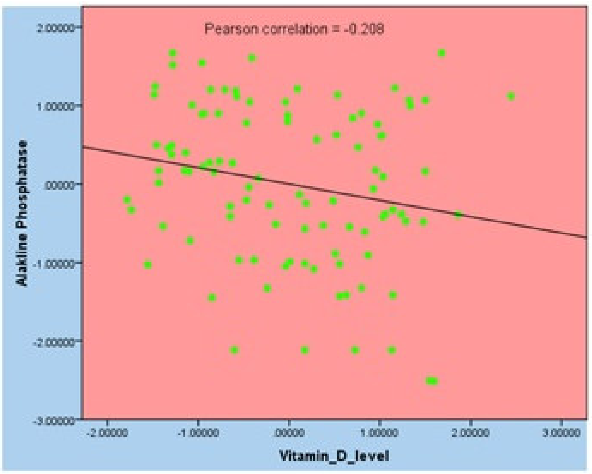
Correlation analysis was done to find the relation between Vitamin D and study variables using Pearson correlation test. When total study population was considered together, significant correlation was found with serum alkaline phosphatase and socio economic status. With deficiency of Vitamin D , there was subsequent increase in serum alkaline phosphatase which was indicated by correlation coefficient of -0.208.Vitamin D was associated negatively with socioeconomic status(-0.223). Among male, significant correlation was found with serum phosphorus(0.289).It was correlated positively with Vitamin D levels. Among females, significant correlation was found in serum alkaline phosphatase(-0.317) and socioeconomic status(-0.507) Serum alkaline phosphatase levels were raised in deficiency status of vitamin D among females.

Table 3
Correlation of Vitamin D with study variables

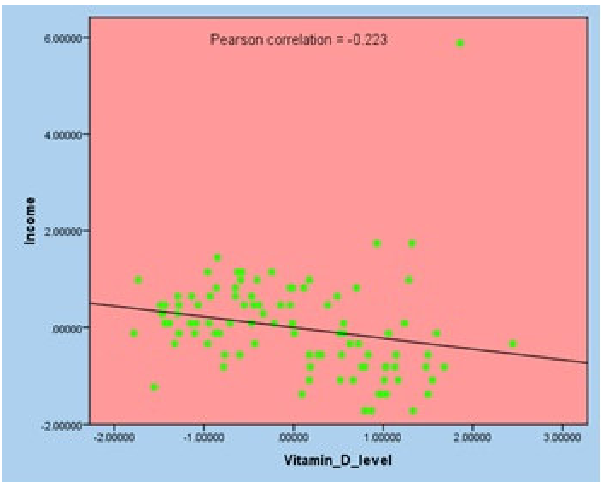
Variable	Total (n=100)		Male (n= 50)		Female (n = 50)	
	Pearson correlation coefficient	P value	Pearson correlation coefficient	P value	Pearson correlation coefficient	P value
Socioeconomic status	-0.223*	0.026	-0.121	0.403	-0.501*	<0.001
Sun light exposure	0.16	0.112	0.106	0.465	0.184	0.2
Serum calcium	0.121	0.232	0.074	0.608	0.201	0.162
Serum Phosphorus	0.188	0.061	.289*	0.042	-0.002	0.989
Alkaline phosphatase	-.208*	0.038	-0.055	0.702	-0.317*	0.025

****Correlation is significant at the 0.05 level (2-tailed).***

Graph 1
Association between serum Vitamin D & alkaline phosphatase levels



Graph 2
Association between serum Vitamin D level & socio economic status



Correlation of vitamin D status with Discrete Study Variables

Fisher exact test was used to test the association between Vitamin D and study variables. When considering male and female together, there exist significant association living condition and school. All the variables were positively associated with vitaminD.AmongMale,vitamin D was associated positively with schooling. Among females, there exist significant association in living condition and schooling. Both the variables were positively associated with vitamin D.In females, the odds of private school children having vitamin D deficiency is 6.25 times higher than children having vitamin D insufficiency.

Table 4
Correlation of vitamin D status with Discrete Study Variables

Variable	Total (n=100)		Male (n= 50)		Female (n = 50)	
	Correlation coefficient	P value	Correlation coefficient	P value	Correlation coefficient	P value
Milk consumption/day	0.204	0.656	0.316	0.534	0.291	0.215
Egg consumption/week	0.173	0.455	0.166	0.8	0.228	0.224
Non Veg consumption/week	0.145	0.373	0.161	0.596	0.008	0.998
Living condition	0.326	0.007*	0.305	0.208	0.398	0.008*
Religion	0.24	0.123	0.317	0.164	0.069	0.998
School	0.355	<0.001*	0.434	0.002*	0.319	0.026*

****correlation is significant at 0.05 level.***

Male and Female difference

Independent t test was used to find the difference. There exists significant difference between male and female in vitamin D levels, Serum phosphorus and alkaline phosphatase levels.

Table 5
Difference between male and female gender

Variables	t test statistic	P value
Socio economic status	-1.082	0.282
Sun light exposure	-1.281	0.203
Vitamin D level	-1.965	0.052*
Serum calcium	0.775	0.440
Serum Phosphorus	-1.930	0.051*
Serum alkaline phosphatase	2.266	0.026*

****Significant at 0.05 level.***

Gender versus discrete study variables

The odds of Underweight children who were females was 3.14 times (CI: 1.291 – 7.653) higher than males, compared with children who were in the normal weight.

Table 6
Gender versus Discrete study variables

Variable	Correlation coefficient	P value	Odds ratio	Confidence interval
Milk consumption/day	0.113	0.732#		
Egg consumption/week	0.220	0.079#		
BMI	0.249	0.01*#	3.14	1.291 – 7.653
Living condition	0.178	0.213@		
Religion	0.23	0.072@		
School	0.160	0.105#		

****Correlation is significant at 0.05 level,***
 # Pearson Chisquare test, @ Fisher test

DISCUSSION

Prevalence of Vitamin D deficiency, insufficiency and normal levels are found to be 59%,36% and 5% respectively in the current study.Similar study conducted in Chennai,showed deficiency of 37.4%, insufficiency of 24.8% and normal levels of

37.8%.Similar study conducted in Mangalore showed deficiency, insufficiency and sufficiency of vitamin D in 39%, 32% and 29% among age group of 1-10 and 71%, 14% and 15% among the age group 11-20 respectively[7].Percentageof hypovitaminosis is more in our study(95%) when compared to study conducted in Chennai[8] which was 62.2%.Even though these studies are conducted in same geographical area in the same year, percentage of optimum Vitamin D in our study is low, may be due to insufficient exposure to sun light by the study population. Mean calcium and phosphorus levels are almost similar but alkaline phosphatase levels were in the lower range compared to study conducted at Chennai [8].Percentage of hypovitaminosis in girls (100%) is matching with the study conducted in Western Saudi Arabia[9], Delhi[10], America[11] where percentage was found to be 96.7% ,90.8% and 71% respectively . Suboptimal Vitamin D percentage is high in girls compared to boys because of more clothing and spending more time indoors.Vitamin D is negatively correlated with socio economic status in this study, because when socioeconomic status is high, time spent outdoor will be less.Alkaline phosphatase levels are increased due to vitamin D deficiency which indicates that bone got affected in our study population.Our findings are supported by elevated alkaline phosphatase observed in a study conducted in children of Jeddah, Saudi Arabia.[12] Vitamin D is positively correlated with school because government school students commuting to school and facility to play only outdoor games makes them synthesise more D vitamin from sun light.Itis awell known fact that, significant direct relationship between 25(OH) levels and sun light exposure.[13,14,15]Mostly the study population are living in concrete or sheet houses which reflects the sun light so as to have positive association with vitamin D.In male population, vitamin D and phosphorus levels are more but in females alkaline phosphatase levels are found to be greater. Underweight females are more than males in our study, according to traditional Indian culture male gender is preferred and well-nourished compared to females. Private school girls were having more Vitamin D deficiency than government school which can be explained by spending time mostly indoors, watching TV, playing computer games, attending tuitions and other extracurricular activities.

CONCLUSION

Prevalence of Vitamin D deficiency is so high in sun rich area like Kancheepuram district which makes us to think seriously about this public health issue.Vitamin D deficiency along with low dietary intake of calcium together will lead to defective bone mineralisation. It is the right time for Indian paediatricians, gynecologists and Indian council for medical Research to come forward and put appropriate guidelines to overcome vitamin D deficiency, a pandemic. Vitamin D having plethora of health benefits either directly or pleomorphically has become essential component of modern medicine in the 21st century.Infants will get enough vitamin D in the serum provided maternal vitamin D has taken care during pregnancy. According to American Academy of Paediatrics, daily supplementation of 400IU vitamin D has to be given to infants, children and adolescents.[16] Pregnant and lactating women should be given 1500-2000IU/day as prescribed by US Endocrine task force[17].Along with vitamin D, calcium supplementation is also must and phytate rich foods should be avoided in order to increase the bioavailability of calcium. Fortification of infant formulas, milk, yogurt, fruit juices, cereals,rice is the best option on day to day basis to bring up vitamin D in the body, but in India, fortification and supplementation is not regulated by the government yet, which has to be addressed on emergency basis to combat deficiency. Encouraging people to expose themselves daily to sun light is the best possible way to ensure optimum vitamin D in Indian subcontinent.

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CONFLICT OF INTEREST

Conflict of interest declared none.

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