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FREQUENCY OF VITAMIN D DEFICIENCY IN HEALTHY ADULT POPULATION - A CROSS SECTIONAL STUDY

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ABSTRACT

Objective: To determine vitamin D, serum calcium and phosphate levels in adults. **Study Design:** Cross sectional study **Study setting & Duration:** Outpatient Department, Indus Medical College Hospital Tando Muhammad Khan from May 2017 to October 2017. **Subjects and Methods:** A sample of 100 volunteer participants (49 male and 51 female) was selected according to pre defined criteria. Venous blood samples were collected under aseptic conditions. Serum calcium and phosphate were estimated by standard laboratory procedures. Vitamin D was measured by ARCHITECT I 1000 system. Data was analyzed on SPSS (ver 22.0). **Results:** Serum calcium, serum phosphate and vitamin D in male and female were noted as 9.21±0.68 and 8.62±0.46 mg/dl (P=0.0001), 3.98±1.02 and 3.39±1.01 mg/dl (P=0.0004) & 28.82±8.71 and 21.73 ± 4.6 ng/dl (P=0.0001) respectively. Mean± SD vitamin D sufficiency, insufficiency and deficiency were noted as 36.65±6.15, 24.60 ±2.35 and 16.52±1.71 ng/ml respectively (P=0.0001). 23% study subjects reveals sufficient vitamin D levels, while insufficiency and deficiency was noted in 77% of subjects (P=0.0001). **Conclusion:** The present study reports a frequency of 77% vitamin D insufficiency and deficiency in aged healthy adults.

Key words: Vitamin D, Serum Calcium, Serum Phosphate, Aged Adults

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INTRODUCTION

Vitamin D is also called the cholecalciferol. It is one of the vital fat soluble vitamins.[1] It is called sunshine vitamin because of its synthesis is stimulated by the sunlight. Biochemically, it belongs to the secosteroid family. Endogenous synthesis occurs in the skin where the 7-dehydrocholesterol is converted into cholecalciferol by ultraviolet rays of sunlight.[1,2] Vitamin D acts as a hormone after hydroxylation in the liver and kidney. Active vitamin D is 1,25-dihydroxy cholecalciferol. It is essentially required for the bone health.[1,2] Exogenous sources of vitamin D are eggs, milk, fish, liver, etc. Daily body need of vitamin D is approximately 15 – 20 μg/day. Intestinal absorption of calcium is vitamin D dependent. In absence of vitamin D, the bones are dematerialized. Vitamin D plays biochemical role in serum calcium, phosphate and magnesium absorption and facilitates bone mineralization.[1,2] Vitamin D increases intestinal calcium absorption and decreases its urinary excretion. Deficiency disorders of vitamin D are of historically important and include the rickets and osteomalacia. Hypoparathyroidism and renal osteodystrophy are other complications of vitamin D deficiency.[3]

Prevalence of vitamin D deficiency ranges from 30%-90%. Beside bone disease, vitamin D deficiency has been associated with various other disease processes. Asthmatics are reported to be vitamin D deficient. Upto 88% of asthmatics showed vitamin D deficiency, this has been

reported. Sufficient, insufficient and deficient levels of vitamin D are defined as >30 ng/dl, 20 – 29.9 ng/dl and <20ng/ml.[3,4] Vitamin D supplementations are a standard clinical practice in developed countries, but condition is worse in developing countries.[5] Vitamin D deficiency increases the risk of infectious disease in children.[6] Vitamin D augments the immune reactions through cathelicidin. Cathelicidin is a peptide that increases the phagocyte activity of macrophages.[7] Vitamin D deficiency may occur by exogenous dietary deficiency and or decreased biosynthesis.[8] Vitamin D deficiency remains clinically asymptomatic till complications appear but they vary from patient to patient.[9] In Pakistan, vitamin D deficiency is a under- diagnosed under- reported nutritional deficiency problem. Vitamin D deficiency is endemic in Pakistan but remains undiagnosed due to asymptomatic course.[10] The present prospective small scale study was conducted to determine serum vitamin D, serum calcium and phosphate levels in healthy adult subjects presenting at our tertiary care hospital.

SUBJECTS AND METHODS

The present cross sectional study was designed to estimate serum calcium, phosphate, and vitamin D levels among healthy adults. The study was conducted at the Outpatient Department, Indus Medical College Hospital Tando Muhammad Khan from May 2017 to October 2017. Study was approved by the institution`s review committee. Study protocol was conducted in accordance to the Helsinki`s declaration of conducting human research. Inclusion and exclusion were applied strictly. Voluntary adult participants were selected from the attendants accompanying the patients in the outpatient department of the hospital through non-probability convenient sampling. A sample of 100 adults; comprising of 51 female and 49 male, were selected according to research criteria. Age 45- 65 years, sunlight exposure, and healthy adults of both gender were included. Subjects with diabetes mellitus, cardiac failure, malabsorption syndrome and chronic diarrhoea were excluded. Female living in congested apartments with strict hirable were also excluded. Healthy adults were screened by proper history and volunteer physical examination. Volunteers with history of multivitamin pill supplementations were excluded too. Final sample of 100 volunteers were selected for blood sampling after careful inquiry of inclusion and exclusion criteria. Volunteers were interviewed for gaining their confidence. They were informed that they have no economical burden to bear, no harm or loss.

They were informed of donating a venous blood sampling along with biodata and physical examination. Participants were given free hand to think about entry to study protocol and discuss with their relative and friends. The volunteers were informed that they may withdraw from study protocol at any time without informing the researcher, and this will not affect their future medical attention. Volunteers were given a free mind to think and agree voluntarily; further informed of not paying for laboratory investigation. Participants were informed to comply with study protocol and cooperate unconditionally. Volunteers signing the consent form were asked for venous blood sampling. They were informed that the blood sample will be used for laboratory investigation only and not for any other purpose. Participants were examined by medical officer. Confidentiality of data was the responsibility of the researcher.

The confidentiality was maintained by maintaining strict privacy of the medical data. Venous blood (5 ml) was centrifuged at x12, 000 g for ten minutes. Sera were preserved in Eppendorf tubes and estimation of serum calcium, phosphate and vitamin D. If laboratory procedure was delayed due to any reason, the sera at -20°C. Vitamin D was measured by ARCHITECT I 1000 system. Data was noted in pre-structured proforma. Statistical software SPSS (ver 22.0) was used for the statistical analysis.

Continuous variables were analyzed by Student`s t-test and results presented as mean +/- SD. Categorical variables were analyzed by Chi-square test (cross tabulation) and results presented as frequency and %. All data variables were analyzed at 95% confidence interval (CI) with P≤ 0.05 taken as statistically significant.

RESULTS

Mean ± SD age of male and female was observed as 55.0 ±6.18 years and 52.11±7.05 years respectively (P=0.032). Of total 100 sample, 51% were female and 49% were male (P=0.97) (Graph 1). Serum calcium, serum phosphate and vitamin D in total male and female study sample were noted as 9.21±0.68 and 8.62±0.46 mg/dl (P=0.0001), 3.98±1.02 and 3.39±1.01 mg/dl (P=0.0004) & 28.82±8.71 and 21.73 ± 4.6 ng/dl (P=0.0001) respectively. Mean± SD vitamin D sufficiency, insufficiency and deficiency were noted as 36.65±6.15, 24.60 ±2.35 and 16.52±1.71 ng/ml respectively (P=0.0001) (Table 2) (Graph 2). 23% study subjects reveals sufficient vitamin D levels, while insufficiency and deficiency was noted in 77% of subjects (P=0.0001) (Table 2) (Graph 3)

Table 1. Biochemical Findings of Study Subjects (n= 100)

	Male	Female	P-value
Calcium (mg/dl)	9.21±0.68	8.62±0.46	0.00001
Phosphate (mg/dl)	3.98±1.02	3.39±1.01	0.0004
Vitamin D (ng/dl)	28.82±8.71	21.73 ± 4.6	0.0001

Table 2. Vitamin D Distribution of Study Subjects (n= 100)

Vitamin D	Mean	SD	P-value
Sufficiency (>30 ng/mL)	36.65	6.15	0.0001
Insufficiency (20- 30 ng/mL)	24.60	2.35	
Deficiency (<20 ng/mL)	16.52	1.71	
Total	25.35	7.85	

Table 3. Vitamin D sufficiency, insufficiency and deficiency (n= 100)

Vitamin D	Frequency	%	P-value
Sufficiency (>30 ng/mL)	23	23	0.0001
Insufficiency (20- 30 ng/mL)	25	52	
Deficiency (<20 ng/mL)	52	25	
Total	100	100	

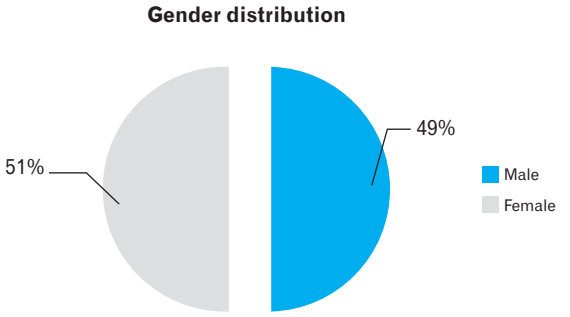

Figure 1. Gender distribution of study subjects

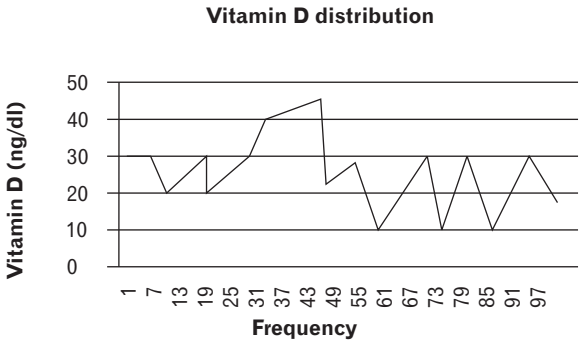

Figure 2. Vitamin D distribution in total study sample

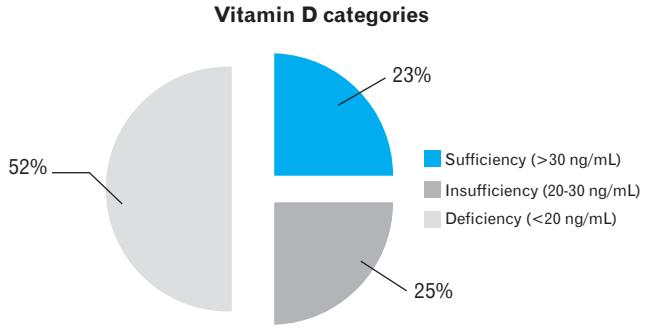

Figure 3. Vitamin D sufficiency, insufficiency and deficiency

DISCUSSION

The present cross sectional study is the first time reporting on the vitamin D deficiency and insufficiency in apparently healthy young adult subject at our tertiary care hospital. We noted vitamin D insufficiency and deficiency frequency of 77% subjects. Only 23% study subjects revealed sufficient vitamin D levels. These are the results of vitamin D levels of healthy young adults. Of total 100 sample, 51% were female and 49% were male (P=0.97) (Graph 1). These findings are in agreement with previous studies.[10,11] Previous

studies[12-14] had reported vitamin D deficiency has become a pandemic health issue. Vitamin D is a stealthy problem that remains ambiguous till a complication does appear. Our results reveal vitamin D deficiency has become a neglected problem that needs routine screening even of healthy adults. In Pakistan, vitamin D has become a health challenge that results in morbidities and increases economical burden to poor population. A previous survey[15] conclude the vitamin D is a multiplying health problem. In present study, healthy aged male and female subjects were included whose mean ± SD age was noted as 55.0 ±6.18 years and 52.11±7.05 years respectively (P=0.032). These findings are concordant to previous studies.[16,17] In present study, the serum calcium, serum phosphate and vitamin D in total male and female study sample were noted as 9.21±0.68 and 8.62±0.46 mg/dl (P=0.0001), 3.98±1.02 and 3.39±1.01 mg/dl (P=0.0004) & 28.82±8.71 and 21.73 ± 4.6 ng/dl (P=0.0001) respectively. These findings are consistent with previous studies.[18-20] In present study, mean± SD vitamin D sufficiency, insufficiency and deficiency were noted as 36.65±6.15, 24.60 ±2.35 and 16.52±1.71 ng/ml respectively (P=0.0001) (Table 2) (Graph 2). These findings are supported by previous studies.[19,20] Vitamin D in male and female as 23.0±8.24 and 27.19±14.13 ng/dl (P=0.006) and vitamin D_3 in total study subjects as 24.80± 11.29 ng/ml. In present study, the frequency of vitamin D insufficiency and deficiency was 77% (P=0.0001) (Table 2) (Graph 3). This much frequency is in agreement with previous studies reported from different parts of Pakistan.[21,22] A previous study[22] reported frequency of vitamin D deficiency of 63.4% and insufficiency of 14.9%. This is in support to the 52% deficiency and 25% insufficiency of present study. Only 23% subjects had normal vitamin D_3 levels. Another study[21] reported vitamin D sufficiency, insufficiency and deficiency in 15.3%, 31.2% and 53.3% of study subjects.[21] Vitamin D deficiency as high as 98.86% has been reported by a previous study.[23] The high frequency of above study is believable because certain pockets of high vitamin D deficiency due to prevailing malnutrition may be present in the society which has never been reported. The findings are consistent with previous studies.[24,25] Mean vitamin D levels of 28.82±8.71 and 21.73 ± 4.6 ng/dl of male and female respectively, indicate the severe vitamin D deficiency (P=0.0001). Jadoon et al[22] reported no significant difference of vitamin D deficiency that is in contradiction to our present study`s finding. From the evident high frequency of vitamin D deficiency of present study in light of literature review, it is concluded that the deficiency of this vitamin may be very high particularly in poor social class of the country that comprises major part of total population. Strength of present study lays in its prospective study design, and inclusion and exclusion criteria, with only limitations of small sample size.

CONCLUSION

The present study reports statistically significantly low serum vitamin D levels in healthy adults. We found a 77% frequency of vitamin D insufficiency and deficiency. More studies are recommended to explore the gravity of problem. Normal adults should be advised for vitamin D screening and supplements.

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2	Ali Akbar Shah	Statistical analysis, Manuscript write up, Proof Reading, Biochemical analysis. Manuscript write up, Proof Reading, Correspondence	
3	Asadullah Yousfani Palli	Concept, Materials handing, manuscript write up, Biochemical analysis and laboratory testing, compilation of results, Proof reading	