ABSTRACT

Objectives
1. To study the Prevalence of Vitamin D deficiency in the sample population.
2. To study the correlation of Serum Ca, Phosphorus and Alkaline Phosphatase with Vitamin D Deficiency in sample population.

Study Design
Descriptive Study

Setting
Local Private Clinic from 1st May to 30th Nov 2009.

Material and Methods
600 subjects in the sample included 300 males and 300 females presenting due to any illness or subjects with or without body aches were enrolled. Blood samples were collected in the morning (over night fasting sample) by venepuncture by disposable syringes and 5 ml blood sample was taken and samples were stored at -20 0 C till they were analyzed . Variable of interest were age, gender, serum calcium, phosphate, alkaline phosphatase, serum vitamin D levels and history of bone or body aches. The study was analyzed on SPSS-Version-10 for windows. P – Value < 0.05 was considered statistically significant.

Results
Results reflected that 77.50% of the sample showed Vitamin D deficiency. Further 18% were in the category of Vitamin D insufficient. Only 4.5% were having values in the normal range. Overall prevalence of Vitamin D deficiency and insufficiency was 95.5%. Among the sample patients only 185 (30.83%) were having bone or body aches as a presenting feature while remaining 415 individuals (69.16%) were having no pains. In our sample all had normal values for serum Ca and Phosphates. However, only 20 patients had modestly elevated level of serum alkaline phosphatase.

Conclusion
Prevalence of Vitamin D deficiency is of magnitude which poses a public health problem. It is suggested that due to its multi system implications patients presenting with different signs & symptoms and especially when to establish a diagnosis is difficult, serum Vitamin D3 levels may be requested. Health education should be imparted to population and awareness should be created to increase the exposure to sunlight to permissible limits. Screening and vitamin D supplementation should be planned to decrease its varied and multidimensional ill effects on health.

Keywords: Vitamin D deficiency, Faisalabad, Serum alkaline phosphatase
INTRODUCTION

Vitamin D is formed in skin by ultra violet light which is the major source (80%) of Vitamin D and its dietary sources are egg yolk, oily fish, butter and milk.\(^{(1)}\) There are a few research publications available to prove that Vitamin D deficiency is not uncommon in Pakistan. Faisalabad is the 3\(^{rd}\) most populous city of Pakistan. It is located at 31°N latitude and 73°E longitude with abundant sunshine throughout the year. The consequences of vitamins D deficiency upon the skeleton are well known.\(^{(2)}\) In adults prolonged deficiency of vitamin D (Calciterol) can lead to osteomalacia\(^{(3,4)}\) while lesser deficiency (insufficiency) is associated with various non-specific symptoms.\(^{(3)}\) Vitamin D deficiency has been observed in developed and developing countries including Middle East.\(^{(5)}\) Many studies show high prevalence of vitamin D deficiency. Skin pigmentation has negligible contribution in reduction of vitamin D formation from sunlight. Avoidance of sunshine or inadequate intake of vitamin D\(^{(5)}\) and malnutrition\(^{(6)}\) may be the main causes. There is increasing evidence that vitamin D insufficiency, by leading to sustained hyperparathyroidism, is prejudicial to the skeleton, particularly cortical bone; it is without symptoms until fractures occur.\(^{(6)}\) Because of high prevalence of vitamin D deficiency in Asia its multi system implications, and as serum calcium and phosphorus levels do not predict exactly its deficiency\(^{(7)}\), with a few studies available in this regard in Pakistan resulted in initiation of this study. The criteria for interpretation of vitamin D3 values are appended below.\(^{(22)}\)

MATERIAL AND METHODS

The study was performed on 600 patients 300 males and 300 females of different socioeconomic background and coming from rural and urban setup. The age groups ranged from 20 to 80 years, mean age being 50 years. Subjects were predominantly married and majority living in their houses or offices and when outdoor most of them only exposed face and hands. Duration to sun exposure was 1 to 3 hours as reported by the subjects. They presented to a private clinic due to any disease; whether presentation was with or without bone or body aches from May 2010 to November 2010. Blood samples were collected in the morning (over night fasting sample) by venepuncture by disposable syringes and 5 ml blood sample was taken and samples were stored at \(-20^\circ C\) till they were analyzed in one of the standardized laboratory of the country. Their serum calcium, phosphate, alkaline phosphatase and serum vitamin D level were measured by one the most standardized laboratory of the country. The study was analyzed on SPSS-Ver-10 for windows. \(P <0.05\) was considered statistically significant. In the study variable of interest were age, gender, serum calcium, phosphate, alkaline phosphatase, serum vitamin D levels and history of bone or body aches.

RESULT

The results of the study were alarming and are appended below. Out of total 600 patients 50\% (n=300) were males and 50\% (n=300) were female. Among these 28 patients (4.66\%) were below age of 20 year, 272 patients (45.33\%) were between 20-40 year, 220 (36.66\%) were between 41-60 year, 78 (13\%) were between 61-80 year and 2 patients (less than 1\%) were above 80 year (Table 1).

<table>
<thead>
<tr>
<th>Age</th>
<th>Vitamin D levels (ng/ml)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;20ng/ml 77.50%</td>
<td>21-29ng/ml 18%</td>
</tr>
<tr>
<td>&lt;20yrs</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>20-40yrs</td>
<td>210</td>
<td>52</td>
</tr>
<tr>
<td>41-60yrs</td>
<td>169</td>
<td>42</td>
</tr>
<tr>
<td>61-80yrs</td>
<td>64</td>
<td>12</td>
</tr>
<tr>
<td>&gt;80yrs</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>465</td>
<td>108</td>
</tr>
</tbody>
</table>

It was observed that 77.50\% of the sample showed Vitamin D deficiency. Further 18\% were in the category of Vitamin D insufficient.

\(\text{Table 1.}\)

\(\text{Vitamin D deficiency Less then 20 ng/ml}\)
\(\text{Vitamin D insufficiency 21-29 ng/ml}\)
\(\text{Vitamin D sufficiency Equal to or more then 30 ng/ml.}\)
\(\text{Vitamin D intoxication More then 150 ng/ml.}\)
Only 4.5% were having values in the normal range (See Chart below). It can be observed that overall Prevalence of Vitamin D deficiency was 95.5%. Similar studies done earlier revealed prevalence closer to our study.\(^{21}\)

**RESULTS OF THE STUDY SHOWING PREVALENCE OF VIT- D DEFICIENCY**

Among the sample patients only 185 (30.83%) were having bone or body aches as a presenting feature while predominant individuals 415 (69.16%) were having no pains (Table 2). Moreover pain has got insignificant relation to any level of serum vitamin D level (\(P=0.251\)) (Table 2). However younger deficient patients were having lesser chance of bone or body aches as compared to age more than 60 year (\(P <0.001\)). It’s worth noting that in our sample all had 30ng/ml. Alternatively 573 (95.50%) had Vitamin D levels less than 30ng/ml. It is evident from Table 3 that statistically significant (\(P <0.05\)) number of patients presented without any bone pain or body aches.

### Table 2.

<table>
<thead>
<tr>
<th>Vitamin D levels</th>
<th>Serum Ca levels</th>
<th>Serum PO(^4) levels</th>
<th>Serum alkaline phosphate levels</th>
<th>Bones or body aches</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.6-10.5 mg/dL</td>
<td>&lt;8.6 mg/dL</td>
<td>2.7-4.8 mg/dL</td>
<td>27-132 iu/dl</td>
</tr>
<tr>
<td>&lt;20ng/ml n=465</td>
<td>465</td>
<td>-</td>
<td>645</td>
<td>20</td>
</tr>
<tr>
<td>21-30 ng/ml n=108</td>
<td>108</td>
<td>-</td>
<td>108</td>
<td>-</td>
</tr>
<tr>
<td>&gt;30ng/ml n=27</td>
<td>27</td>
<td>-</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>600</td>
<td>600</td>
<td>580</td>
<td>185</td>
</tr>
<tr>
<td>P-value</td>
<td></td>
<td></td>
<td>P &lt; 0.05</td>
<td>P &gt; 0.05</td>
</tr>
</tbody>
</table>

**DISCUSSION**

Vitamin D deficiency is not an uncommon disease in the world; it has been widely reported in all age groups in recent years. Rickets has never been eradicated in developed countries as well\(^9\). Hypovitaminosis and Vitamin D deficiency has been in developed and developing countries including several in the Middle East\(^5\). Vitamin D is important for calcium absorption and bone growth\(^5\). Beside disease of bones it has wide range of health implication; early life vitamin D inadequacy is a causative factor in development of certain autoimmune disease\(^{9,10,11}\) like type 1 diabetes\(^{10,11}\), rheumatoid arthritis\(^{12}\) and certain cancers later in life\(^9\). Vitamin D deficiency exists in

### Table 3.

<table>
<thead>
<tr>
<th>Age</th>
<th>Presentation</th>
<th>Was no presentation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20yrs</td>
<td>00</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>20-40yrs</td>
<td>21</td>
<td>190</td>
<td>211</td>
</tr>
<tr>
<td>41-60yrs</td>
<td>64</td>
<td>147</td>
<td>211</td>
</tr>
<tr>
<td>61-80yrs</td>
<td>97</td>
<td>54</td>
<td>151</td>
</tr>
<tr>
<td>&gt;80yrs</td>
<td>03</td>
<td>01</td>
<td>04</td>
</tr>
<tr>
<td>Total</td>
<td>185</td>
<td>415</td>
<td>600</td>
</tr>
</tbody>
</table>

\(P<0.05\)
patients with tuberculosis and it is possibly a cause rather than effect of the disease.\(^7\) It is part of the pathology of Alzheimer’s, Parkinson’s and some peripheral neuropathies including Restless legs syndrome.\(^{13}\) Vitamin D deficiency may also be linked to an increased susceptibility to several chronic diseases such as high blood pressure\(^{14}\), periodontal disease, multiple sclerosis\(^{12}\), chronic pain, depression, schizophrenia, seasonal affective disorder, peripheral artery disease.\(^{13}\)

Risk of Myocardial Infarction (MI) doubles in patients with 25 OH Vitamin D levels <34ng/ml. Studies have shown that Congestive Heart Failure patients have much lower 25 OH Vitamin D levels than controls.\(^{15,24}\) Low Vitamin D level has association with insulin resistance and Beta-cell dysfunction. Highest Vitamin D levels associated with 60% improvement in insulin sensitivity.\(^9\) A study showed that 48% of patients with Multiple Sclerosis (MS) were found to be having vitamin D deficiency.\(^{16}\) Out of 299 patients with Low Back Pain (LBP) 83% had vitamin D deficiency.\(^{12}\) Study with 150 patients with persistent, nonspecific musculoskeletal pain at Mayo clinic revealed that 93% had vitamin D deficiency.\(^{17}\)

As data of adult Pakistani population, as far as deficiency of vitamin D is concerned, is lacking so this study was conducted to determine the prevalence of vitamin D deficiency in out patient clinic, its relation to presenting symptom of bones or body aches and to the serum level of calcium, phosphate and alkaline phosphates.

The study showed significantly high prevalence of vitamin D deficiency in the Target population of Faisalabad in month of July; peak summer season in Faisalabad. Deficiency recorded in our study in sample population was 95.5% (79% deficient and 20% were having insufficient levels). These results do not match the existing international data, showing 14.5% in U.K reaching to more than 30% in age above 65 years\(^3\), 24.3% in United States\(^4\), 12.5% in Italy\(^4\), 55% in Irish females 20% and 83% in Saudi Arabia.\(^{18}\) Possible factors may be due to decreased intake or lack of sun exposure due to social, cultural or religious reasons.\(^{17}\)

Vitamin D deficiency is one of the important risk factors for hip fractures, but the easiest to correct.\(^{19}\) Vitamin D deficiency is not uncommon in the elderly, especially in patients with hip fracture. Elderly people infrequently stay outside in the sunshine, and nutrition is deficient in vitamin D.\(^{19}\) The results of the present study were different to the mentioned international data as in this study. There were only 155 (25.8%) patients above age 60 year remaining 445 (74.16%) patients were below 60 year of age and all were deficient in vitamin D. This difference perhaps may be attributed to fact that majority of sample presented in the clinic was below 60 year. However, vitamin-D deficiency in less then 60 year age group is really eye opener.

Vitamin D deficiency can occur without any symptoms. If symptoms are present, it indicates severe deficiency.\(^7\) Similar observations were made in this study, only 31% patients were having bones or body aches on presentation while remaining 69% were having no complains showing insignificant relation between deficiency and symptoms (P >0.05). Hence, the concept that musculoskeletal pain are directly associated with vitamin D deficiency\(^{17}\) is not matched to the results of this study. However, young deficient patient were having lesser chance of having bones or body aches as compared to the above 60 year population (P-value <0.05).

This study also establishes the fact mentioned in international literature that vitamin deficiency has no relation to the serum calcium, phosphate and alkaline phosphates levels.\(^7\) In our study all the vitamin D deficient population was having normal serum calcium, phosphate, while only 20 patients were having modestly elevated levels of Alkaline Phosphates. All this discussion endorses the fact that vitamin D is much more prevalent in this part of the world.

**CONCLUSION**

Vitamin D deficiency is much more prevalent in our community as compared to published Western data, particularly young population is more suffering to this new endemic, more ever often it is asymptomatic and also serum
calcium, phosphate and alkaline phosphates levels are not predictable indicator of its underlying deficiency. It is suggested that due to its multi system implications patients presenting with different signs and symptoms and where to establish a diagnosis is difficult, serum vitamin D3 levels may be requested. Moreover, to overcome this issue it is recommended that health education be imparted to population and awareness should be created to increase the exposure to sunlight to permissible limits. Mass level screening and vitamin D supplementation should be planned to decrease it’s varied and multidimensional ill effects on health. Sample size in this study is very small. However, it may be taken as an inspiration to conduct more research work to address this important health issue and to prevent all the ill effects produced by its deficiency.

**Limitation of Study:**

We had several limitations; study was done at one point of time. We were not able to calculate the daily dietary intake of vitamin D due to several reasons. Duration of sun exposure was based on recall rather than actual. In the study we also ignored the overcast and rainy spells during study period. Furthermore, we did not measure the serum parathyroid hormone level due to limitation of resources.

**Conflict of Interest:**

None

**REFERENCES**

16. Findings presented at the American Society of Clinical Oncology’s annual meeting in Chicago on 30 May 2008, as reported in the *Sydney Morning Herald* on 1 June 2008.