Vitamin D deficiency (VDD) is a global public health issue and is on the rise in Pakistani population. In a study, Pakistani immigrants in Norway had alarmingly low levels of 25-hydroxy D (25[OH]D) (< 24.9 nmol/L).1 Seventy eight per cent of the hospital staff in Lucknow India were found vitamin D deficient.2 Similarly, in a study conducted in Lahore, Pakistan VDD was observed in 81% of the pre-menopausal women.3 A recent report from an adult ambulatory care setting in Karachi revealed 62% severe VDD.4 In one of our studies on healthy volunteers, low serum 25[OH]D was found in 94.3% of the females and 88.6% of the males.5

Sunlight exposure is an important determinant of serum 25[OH]D levels. At an individual level, factors associated with low sunlight exposure include conservative clothing practices, use of sunscreens, darker skin tone, physical barriers such as glass windows of cars and offices, and house bound individuals who may have little exposure to sunlight. In addition to the individual level factors, household level factors may also influence sunlight exposure. A study on Saudi Arabian women showed severe VDD in apartment dwellers as compared to those women living in villas with more exposure to sunlight.6 The aim of the present study was to study the association between place of residence and 25[OH]D levels of individuals.

Data of those who had 25[OH]D levels assessed (n = 19073) at the Aga Khan University (AKU), Clinical Laboratory, Karachi, from January 2007 to June 2008 were reviewed. Those samples from areas outside Karachi were excluded. Samples received from November to February were included in the winter season and summer months were from March to June. The residential addresses were categorized into ten neighbourhoods with distinct housing structure attributes and localities. A high frequency of VDD in all the studied localities of an urban city warrant dietary vitamin D supplementation and food fortification.

**Key Words:** Vitamin D. Deficiency. Urban. Localities. Housing.
Vitamin D status in different localities of Karachi

### Table I: Vitamin D status in individuals residing in Karachi, Pakistan (n = 4788).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age groups (years)</th>
<th>Male</th>
<th>Female</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 18</td>
<td>19 – 50</td>
<td>&gt; 51</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1393</td>
<td>3395</td>
<td>318</td>
<td>2128</td>
</tr>
<tr>
<td>Mean 25(OH)D (±SD) nmol/L</td>
<td>44.4 (±38.7)</td>
<td>45.9 (±35.1)</td>
<td>50.4 (±42.9)</td>
<td>39.1 (±34.1)</td>
</tr>
<tr>
<td>Deficiency (%) (n)</td>
<td>69.7 (971)</td>
<td>70.7 (2400)</td>
<td>67 (213)</td>
<td>77.3 (1646)</td>
</tr>
<tr>
<td>Insufficiency (%) (n)</td>
<td>15.15 (211)</td>
<td>13.6 (462)</td>
<td>12.6 (40)</td>
<td>11.3 (240)</td>
</tr>
<tr>
<td>Sufficiency (%) (n)</td>
<td>15.15 (211)</td>
<td>15.7 (533)</td>
<td>20.4 (65)</td>
<td>11.4 (242)</td>
</tr>
</tbody>
</table>

Vitamin D deficiency is defined as < 50 nmol/L, insufficiency as 50 – 75 nmol/L and sufficiency as > 75 nmol/L. Neighbourhood grouping was done as follows: Group I: ‘Clifton’, Group II: ‘Defence’, Group III: ‘Federal B Area’, Group IV: ‘Garden and Saddar’, Group V: ‘Gulshan and Gulistan-e jauhar’, Group VI: ‘Landhi, Malir and Korangi’, Group VII: ‘North Nazimabad and North Karachi’, Group VIII: ‘PECHS and Bahadurabad’, Group IX: ‘Site, Orangi and Nazimabad’ and Group X: ‘PIB Colony’. Comparison between gender and age groups was done using independent t test. Comparison between neighborhoods was done using ANOVA and post hoc analysis. Mean with similar alphabets are statistically non-significant (p-value < 0.05).

48.5 ± 18.6 years. The majority (70.9%) were females. Overall median estimate of 25(OH)D was 33.94 (IQR 3.99 – 196.6) nmol/L. Though all age groups were affected, however, more severe 25(OH)D was seen in 19 – 50 years age group (p < 0.01). Mean 25(OH)D levels were significantly different between males and females (p < 0.01). Similarly, mean log 25(OH)D levels were higher in summers (1.14 ± 0.37 nmol/L) as compared to winters (1.05 ± 0.41 nmol/L; p < 0.01).

Vitamin D deficiency was observed in 73.7% subjects, insufficiency in 13.8% and 12.5% were identified to have sufficient levels. Statistically significant difference between mean log 25(OH)D of participants residing in different neighbourhoods of Karachi was observed (p < 0.01). Post Hoc test results reflected that lowest 25(OH)D levels were observed in residents of Landhi, Malir and Korangi (Table I).

Average sunshine in Karachi is 304 hours/month during summer and 280 hours/month during winter. It is unclear why the prevalence of VDD was so high in all the ten localities despite stark differences in sunlight exposure. The dietary habits can also be blamed as food is often overcooked destroying most of the vitamins and micronutrients in it. Therefore, vitamin D intake through food was probably low.

Another hypothesis is that air pollution prevents adequate UV exposure to skin. The level of air pollution in Karachi is significantly higher than World Health Organization (WHO) standards. A 2003 – 2004 air quality survey by Pakistan Space and Upper Atmosphere Research Commission showed bad air quality in Karachi. Mean (in 48 hours) cars, buses, trucks and rickshaws counted per day at monitoring sites were 6330, 6512, 1112 and 1161, respectively. All these could be contributing to defective UVB light penetration and hence VDD and this area needs to be thoroughly investigated.

Limitations of this report include the lack of information on housing structure. Quantitative measurement of time spent indoors / outdoors was missing, hence we could not use serum 25(OH)D as surrogate marker for sunlight exposure. Furthermore, one sample per individual is not sufficient to obtain a long-term 25(OH)D status.

The study indicates that both high and low-income localities of both urban and rural environments are at risk of developing VDD. A prospective study should be planned that includes the validation of dietary assessment tools for measuring the intake of vitamin D and calcium along with housing structures of each locality. The need to develop and validate sunlight exposure questionnaires to accurately capture vitamin D status also exists.

REFERENCES


