

## An audit of clinical laboratory data of 25 [OH]D at Aga Khan University as reflecting vitamin D deficiency in Pakistan

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### Abstract

**Objectives:** To estimate the burden of Vitamin D deficiency in people from different geographical areas of Pakistan.

**Methods:** The retrospective study was conducted at the Aga Khan University Hospital, Karachi, and comprised specimens of subjects tested for 25-hydroxy D at the clinical laboratory between September 2010 and September 2011. Serum samples received from the phlebotomy centres all over Pakistan and the main laboratory in Karachi were included. SPSS 19 was used for statistical analysis.

**Results:** Of the 60937 specimens in the study, 18721 (30.7%) related to men. The overall mean age was 40.5±19.7 years, and median 25-hydroxy D level was 13.5ng/ml (interquartile range: 25.1-7.4 ng/ml). Overall, mean log 25-hydroxy D was 1.14±0.39ng/ml (median: 13.5ng/ml; interquartile range: 25.1-7.4 ng/ml). Out of the total, 40279 (66.1%) subjects were vitamin D-deficient.

**Conclusion:** Vitamin D deficiency was common among the subjects.

**Keywords:** Vitamin D, Deficiency, Prevalence. (JPMA 65: 1226; 2015)

### Introduction

The emergence of Vitamin D deficiency (VDD) as a global pandemic has made it a topic of increasing importance in recent research, and studies from all across the globe testify to the prevalence of VDD in a significant proportion of their population based on the measurement of 25-hydroxy D (25[OH]D) below 20ng/ml.<sup>1-3</sup> Pakistan is a sun-drenched country relatively closer to the sunlight-rich equator with summer temperatures often higher than 35°C. Hours of sunshine in Pakistan range between 6.8 hours/day in January and 9.9 hours/day in May.

VDD has been studied in diverse populations in Pakistan, including healthy volunteers (VDD=94.3% in females and 56.9% in males; n=123), ambulatory care patients (92%; n=119), urban community (90.1%; n=305), pregnant females (72%; n=75), newborns (88%; n=50), pre-menopausal females (82.8%; n=174) and post-menopausal females (75.6%; n=37).<sup>4-10</sup> Factors like skin pigmentation, traditional clothing (gowns in case of women), and limited outdoor activities are proposed as reasons that may account for this striking VDD, but the small sample size of the studies limit the understanding on the underlying determinants.

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While the current evidence clearly highlights the need to understand the prevalence and the factors governing it, there is paucity of a national data on VDD. Health information systems in Pakistan are fragmented and vertical; they either serve the health programmes that created them or are inaccurate.<sup>11</sup>

The current study was planned to estimate VDD reported from the clinical laboratory in an urban centre that received specimens from different geographical areas of Pakistan. We also compared the extent of VDD identified in females from the laboratory data with the National Nutrition Survey (NNS) 2011 of Pakistan in pregnant and non-pregnant females.<sup>12</sup>

### Material and Methods

The retrospective study was conducted at Aga Khan University Hospital (AKUH), Karachi, and comprised specimens received from across the country at the main clinical laboratory between September 2010 and September 2011. The extent of VDD identified in females from the laboratory data was compared with the National Nutrition Survey (NNS) 2011 of Pakistan in pregnant and non-pregnant females (8). Exemption was obtained from the institutional ethical review committee.

The laboratory provides a three-tier system comprising a tertiary laboratory in main hospital in Karachi, 12 smaller laboratories providing routine testing facilities in eight cities of the country and 206 phlebotomy

centres all over the country. Results of 25[OH]D from specimens received from collection points from all over Pakistan and at the main laboratory in Karachi were included. Cut off for 25[OH]D levels < 20ng/ml was taken as deficient.<sup>13</sup>

SPSS19 was used for statistical analysis. Log transformation was performed as serum 25[OH]D was not normally distributed. For mean comparison, independent sample t-test and analysis of variance (ANOVA) was applied.

## Results

Of the 60937 specimens in the study, 18721(30.7%) related to men. The overall mean age was 40.5±19.7 years, with 30744(50.5%) belonging to the 19-50 years age group. Median 25[OH]D was 13.5ng/ml (interquartile range [IQR]: 25.1-7.4 ng/ml). Overall, mean log 25[OH]D was 1.14±0.39 ng/ml (median: 13.5 ng/ml; IQR =25.1-7.4 ng/ml). Out of the total, 40279(66.1%) subjects were vitamin D-deficient (Table-1).

Participants belonging to Khyber Pakhtunkhwa (KPK) had the lowest 25[OH]D levels (median: 11.0ng/ml; IQR:20.7-

6.4ng/ml). Subjects from Azad Kashmir had the highest levels (median: 17.1ng/ml; IQR =28.7-9.2ng/ml) Results were also compared with the NNS 2011 data on females (Table-2).

## Discussion

Our results reiterate the results of NNS 2011. This data along with the data from the community females provide a fair representation of the entire population. It provides a holistic status of VDD; results broadly indicating that VDD in Pakistan is not limited to gender, age group or province. The reasons for VDD in the age group 19-50 compared to the other two extremes is inquisitive, considering that this age group usually does not stay indoors and goes out for work. With rapid urbanisation and modernisation, lifestyle factors are increasingly recognised as the main determinants of VDD.<sup>14,15</sup>

World Health Organisation (WHO) categorises the health information system under five interrelated subsystems; one of which is routine service reporting.<sup>16</sup> Laboratory forms and service delivery records are important curative data collection instruments for patient/client management. Our laboratory data provides a rapid

**Table-1:** Levels of serum 25-hydroxy D (25[OH] D) according to age and gender.

Age groups (years)	Overall n=60937			Males n=18721			Females n=42216			p value
	n	Mean log 25[OH]D (±SD) ng/ml	VDD %	n	Mean log 25[OH]D (±SD) ng/ml	VDD %	n	Mean log 25[OH]D (±SD) ng/ml	VDD %	
≤18	9204	1.21(±0.40)	57.8	4164	1.26(±0.38)	55.7	5040	1.16(±0.41)	64.3	<0.01
19-50	30744	1.09(±0.38)	71.9	7547	1.11(±0.34)	74.5	23197	1.09(±0.39)	71.0	<0.01
>50	20989	1.21(±0.37)	58.7	7010	1.21(±0.33)	62.1	13979	1.21(±0.38)	52.7	>0.05

VDD: Vitamin D deficiency  
SD: Standard Deviation.

**Table-2:** Mean log 25-hydroxy D (25[OH] D) levels of subjects belonging to various regions of Pakistan: comparing findings of National Nutrition Survey 2011, with our study.

Location	Overall			Males			Females Our data			Females NNS 2011		
	n	Mean log 25[OH]D (±SD) ng/ml	VDD %	n	Mean log 25[OH]D (±SD) ng/ml	VDD %	n	Mean log 25[OH]D (±SD) ng/ml	VDD %	p value	VDD Non-pregnant mothers %	VDD Pregnant mothers %
Overall	60937	1.14 (±0.39)	66.1	18721	1.17 (±0.36)	66.1	42216	1.13 (±0.40)	66.1	<0.01	66.8	68.9
Sindh	46000	1.14 (±0.39)	65.8	14602	1.17 (±0.36)	66.3	31398	1.13 (±0.41)	65.5	<0.01	71.2	66.9
Punjab	10919	1.13 (±0.38)	68.1	3012	1.17 (±0.35)	67.0	7907	1.11 (±0.39)	68.5	<0.01	66.4	77.1
Balochistan	1218	1.09 (±0.45)	68.5	291	1.16 (±0.41)	68.4	927	1.07 (±0.46)	68.5	<0.05	54.6	43.6
Khyber Pakhtunkhwa	744	1.07 (±0.41)	73.8	192	1.17 (±0.40)	70.8	552	1.04 (±0.41)	74.8	<0.01	61.0	63.8
Gilgit and Baltistan	153	1.11 (±0.38)	68.1	17	1.24 (±0.40)	58.8	136	1.10 (±0.38)	69.4	>0.05	80.9	76.1
Azad and Jammu Kashmir	1903	1.22 (±0.36)	57.4	607	1.26 (±0.34)	55.4	1296	1.20 (±0.37)	58.4	<0.01	66.8	73.4

VDD: Vitamin D deficiency  
SD: Standard Deviation.

assessment of the overall VDD in Pakistan. Similar information has been observed at institutes in other cities from different laboratories (personal discussion) and can be used to assess the prevalence and magnitude of VDD. The ultimate objectives of any health information system is not to gain information only, but to ensure the use of information generated to improve management by increasing the efficiency of health services. This evidence together with other reports evolving from different centres is sufficient enough to establish priorities and plan preventive programmes, identify high-risk groups, help understand the local epidemiological trends and patterns. The information can be utilised by the policy makers and healthcare providers in health planning.

Recently, we also observed a change in the trend in 25[OH]D data with more cases being identified with high and toxic levels; while the frequency of VDD has remained the same. Multiple reports of vitamin D intoxication are emerging from various parts of the world,<sup>17-19</sup> highlighting the need for caution when prescribing vitamin D supplements and injections. We reported 72 cases out of 2249 cases of children less than one year of age tested at our laboratory with levels greater than 150 ng/ml.<sup>20</sup> Replacement of vitamin D for maintaining sufficient bone health is necessary, but achieving balance between optimal and toxic levels is equally important. An area of urgency in our setup is to have clear-cut guidelines/strategies for correcting VDD in our patient population.

Countries where food fortification practices are available have reduced VDD by creating extensive awareness on the use of fortified foods.<sup>21</sup> Common food items like bread, cereals, oil, milk and other dairy products can be fortified with vitamin D. So far we are not aware of any policy for food fortification with vitamin D or its implementation process in our country. Although food fortification alone will not combat this deficiency, but it is an important step towards reducing the prevalence of VDD and its associated health conditions.

Limitations of our study include the lack of information of general health status of the subjects like dietary habits, pregnancy, lactation, drug history, menstrual history, housing structure, sunlight exposure, and one sample per individual is not sufficient to obtain a long-term 25[OH]D status. Furthermore, laboratory surveillance differs from population-wide surveillance in that it can only monitor patients who are already receiving medical treatment or are privileged and

therefore get their lab tests done. For this reason, it does not identify patients who have never been tested. However, the burden of VDD is evident from the fact that since year 2000 when 25[OH]D testing was introduced at our laboratory, we have been reporting 80-90% VDD in clinical specimens in each batch analysed from our referral labs.

## Conclusion

There is need for widespread VDD awareness amongst community via mass media and newspapers. It is important that different groups with common interest should jointly develop guidelines and intervention strategies for dealing with VDD in our population. For long-term strategies to address VDD, we propose the formation of a VDD Working Group which can then contribute to evidence-based policy-making.

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