ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 1(H), pp. 23420-23426, January, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

VITAMIN D: REALITY OR HYPE?: A CASE STUDY OF COMBINED DATA OF SURAT, AHMEDABAD AND VADODARACITY

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DOI: http://dx.doi.org/10.24327/ijrsr.2018.0901.1465

ARTICLE INFO

Article History:
Received 15th October, 2017
Received in revised form 25th October, 2017
Accepted 23rd December, 2017
Published online 28th January, 2018

Key Words:

Vitamin D3, Parametric Limits, Nonparametric limits, Statistical significance

ABSTRACT

India, though a sunshine country, it is reported that prevalence of Vitamin D (D3) deficiency is not only significant to the extent of 85-90% but is also widespread. Unfortunately, we are unable to find authentic studies on the normal values of Vitamin D3 in Indian population. The studies that are available have a small sample size and only longitudinal studies are carried out.
Therefore in this paper an attempt has been made to give an idea of a picture regarding the level of vitamin D in Gujarat for some selected cities. Major findings are (1)There is statistically significant difference between age wise as well as sex wise D3 level.(2)In future 66.01% to 87.41% will have deficiency of Vitamin D3. (3) Children have less deficiency than adults and senior citizens.

INTRODUCTION

India, though a sunshine country, it is reported that prevalence of Vitamin D (D3) deficiency is not only significant to the extent of 85-90% but is also widespread. Vitamin Dis also known as Cholecalciferol. Unfortunately, we are unable to find authentic studies on the normal values of Vitamin D3 for Indian population. The studies that are available have a small sample size and only longitudinal studies are carried out. There is no cross sectional studies of normal Vitamin D3 levels for Indian population with sufficient sample size, to make it statistically significant.

Unfortunately, the definition of normal values for Vitamin D varies rather widely. In India, most of the laboratories report Vitamin D levels as deficient, insufficient, sufficient and toxic. Accordingly, serum levels of 25(OH) D less than 10ng/mL is considered deficient, between 11 to 30 as insufficient, between 30 ng/ml to 100 ng/ml as sufficient and above 100 ng/ml as toxic. However, these are western values, and its relevance to Indian population is not determined. Again the significance of values deficient and insufficient is also not determined. There is no unanimity amongst experts about normal levels of Vitamin D as limits by IOM (Institute of Medicine) and those given by U S Endocrine society are quite different as mentioned in table: 4.

Therefore, it is perhaps necessary to note that, before starting therapy for severe Vitamin D deficiency, we should check the status with respect to Calcium, Phosphorus and PTH levels.

Measurements of Vitamin levels

The assays of Vitamin D3 are performed by 4 methods: (a) High Performance Liquid Chromatography (HPLC), (b) tandem mass spectrometry; (c) Radio immunoassays using monoclonal antibodies; (d) chemiluminescent protein binging assay. Most of the laboratories in India use this chemiluminescent protein binging assay method.

Sources of Vitamin D

Most important source of Vitamin D is sunlight, especially exposure of the skin to UVB radiation of the sunlight, and less than 10-15% from dietary sources. The sunlight is composed of EMR of varying wavelengths ranging from long lambda (IR) to short UVB radiation. The sunlight that reaches the earth has 90% UVA radiation whereas only 7-10% is UVB radiation. It is UVB radiation that produces Vitamin D in skin. The production of Vitamin D in the skin is affected by time of the

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day, year, latitude, altitude and prevailing weather conditions where we live. Because of the direct sunlight (angle at which the sunlight hits the ground—angle of incidence) is high compared to what it is in western countries (-differences in latitudes at which our country and western countries are).Hence UVB rays hit more directly, our country enjoys more UVB advantage over western countries. The disadvantage of UVB light is possible development of skin cancer but in dark skinned people, the risk of this and melanoma is very little. Remember that children have greater capacity to produce Vitamin D compared to old people and hence require less exposure. Excessive exposure to UVB does not lead to toxicity of Vitamin D. People have tendency to use sun creams to protect skin. Sun creams filter out UVB rays which leads to inadequate availability of UVB rays for Vitamin D production through skin. This brings the vital question that given all favourable conditions, why Vitamin D deficiency and insufficiency is so common in our country or has it to do with poor calcium intake in diet or some PTH abnormalities or has to do with Vitamin D receptors? That leads us to current study.

LITERATURE REVIEW

Cupisti, *et al*.(2015) discussed about the factors associated with vitamin D deficiency. They have considered a group of 405 patients who have chronic kidney disease with stage 2 to stage 4 living in Italy. They observed that 66.4% patients had deficiency and 16.5% patients had insufficiency of vitamin D. Univariate analysis showed that vitamin D was negatively related to age, parathyroid hormone (PTH), protein, and Charlson index, while positively related to hemoglobin level. Multiple regression analysis showed that all factors were associated except age and PTH. No relation was found between renal function and vitamin D deficiency.100 consecutive patients out of 405 patients were given 1000 IU supplements of vitamin D once a week for 12 months. Oral vitamin D supplements reduced PTH serum level. So as a regular practice in CKD patients, vitamin D supplements were recommended.

Tokmak, *et al*.(2008) conducted study between May 2004 to June 2006 on 64 hemodialysis patients (26 females and 38 males) of a German outpatient centre. It was observed that majority of hemodialysis patients have vitamin D deficiency. The study was divided in to two phases: replenishment and maintenance. During the replenishment phase, patients were given 20000 IU of cholecalciferol, in a form of capsule, once a week for 9 months (till Feb, 2005). From these 64 patients, 59 reached to maintenance phase. These59 patients were randomized in treated group (30 patients) and untreated group(29 patients).20000 IU of cholecalciferol once a month for next 15 months (March 2005 to May 2006) was given to the patients of treated group. Finally analysis was done on 23 patients of treated group and 19 patients of untreated group. 57% of the patients achieved recommended levels. However additional study is required to decide ideal dosage of vitamin D to achieve and maintain vitamin D levels in the majority of patients.

Mathur, Naing, Mills, & Limsui (2017) have conducted a study at Community Regional Medical Center, Fresno, CA from 2012 – 2013on 18 patients with Ulcer Colitis and have vitaminosis D with double blinded randomized trial. 8 patients were given 2000IU/daily oral vitamin of D3 and 10 patients were given 4000IU/daily oral vitamin of D3 for 90 days. Short IBD questionnaire for quality of life, partial mayo score for UC disease activity and serum levels were compared between both groups to assess before and after vitamin D3 therapy using paired test. It was observed that vitamin D3 at 4000IU/day was more effective than 2000IU/Day in UC patients with deficiency of vitamin D. Vitamin D3 suppliments improved quality of life in UC patients but clinically significant improvement is not established.

Shah, *et al*. (2013)planned to study 510healthy staff members of Fortis Hospital of Mumbai. Amongst them, subjects less than18years, children, pregnant, lactating mothers, person with acute or terminal illness, uncontrolled hypertension or diabetes, any form of endocrine disorder, person receiving any therapy in the preceding one week which would affect vitamin D3. 474 subjects were available with this complete baseline and follow up data were available for 234 subjects out of which 178 subjects consumed 60000IU/week for eight weeks. At baseline 94.94% subjects were found to be vitamin D deficient with average of 9.36 ng/ml. After 60 days (at the end of the study), average vitaminD3 was 29.08 ng/ml. The study showed that vitaminD3deficiency was highly available in healthy adult population and 8 weeks oral supplement of 60000IU/week increased vitamin D3 at optimal level.

Data Collection and Data description

We have collected data from different laboratories and doctors from Ahmedabad, Surat and Vadodara. But following points should be kept in mind while making any general statement.

- Majority of the data are due to the suggested blood test following some health problems. Very few observations are from free checkup camp.
- For many cases, observations were given as > some value, in those cases for the sake of analysis we have taken next integer value as the observed value, therefore instead of mean we suggest to observe median as the measure and hence for inference nonparametric techniques are used.
- In Ahmedabad data neither sex nor the age is specified therefore we tried to identify the sex from the names. So there chances of mistake to identify the sex as some names may be common for both male and female. Whereas in data from Surat and Vadodara, sex is mentioned as only male and female. So child category is prepared from male and female whose age is up to 15.
- For all the categories (sex wise as well as age wise) common limits are used.

D3 Analysis of collected data from different labs of considered cities

Number of data is displayed in the following table: 1. From these data, we have prepared 3 age categories and three sex categories. Then using different limits of D3 level in blood by (1) regular limits used by the laboratories in India (2) suggested by IOM and (3) Suggested by U S Endocrine society, we have compared the respective descriptive & inferential statistics and findings are reported thereafter.

Table 1 details of No. of data

City	no. of observations	Obs.s with age
Surat	1940	1940
Vadodara	2880	2878
Ahmedabad	818	0
Total	5638	4818

Table 2 age wise category

Age wise Category	Age
Child (C)	0 - 15
Adult (A)	15 -60
Senior citizens (S.C.)	≥ 60

Table 3 Sex wise Category

Child (C)
Male (M)
Female (F)

Table 4 Different limits used for analysis (ng/ml)

Level of D3	Indian labs	IOM	U S Endo. Soc.
Severe deficiency	--	<5	--
Deficient	0-10	5 - 15	0 - 20
Grey area	--	15 - 20	--
Insufficient	10--30	--	21 - 30
Sufficient	30--100	20 - 50	30 - 150
Toxic	>100	>50	>150

Statistical analysis

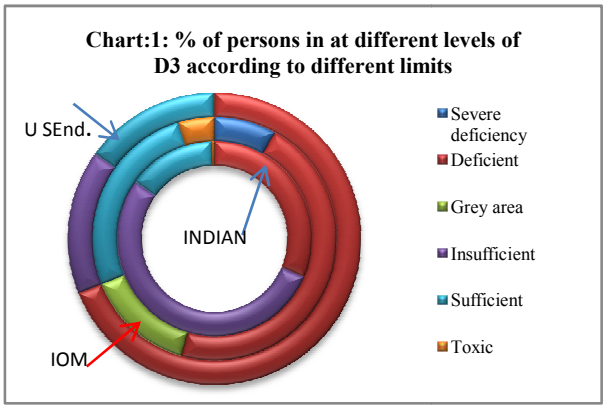
Comparisonson the basis of descriptive statistics

Overall comparison

In the given sample of 5638 persons, percentage of people having different levels of D3 according to different specified limits are reported in the following table: 5. From the table it is very clear that considering any limits, almost 69% to 85% of people are having D3 level below sufficient or the other way only 14% to 26% of people are found to have sufficient level of D3.

Table 5 % of persons in at different D3 levels according to different limits

Level of D3	Indian	IOM	U S Endo.Soc.
Severe deficiency	--	8.2	--
Deficient	31.4	46.2	68.9
Grey area	--	14.5	--
Insufficient	53.4	--	16
Sufficient	14.6	26.3	15
Toxic	0.5	4.8	0.1



From the table of percentile it becomes easier to observe that how many % of people are having the D3 level below that particular value.

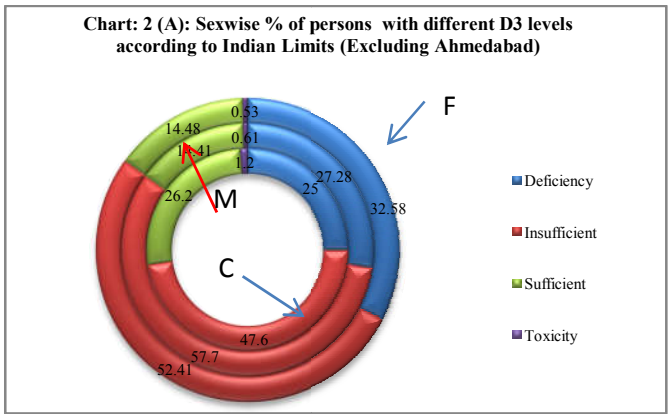
Table 6 Descriptive statistics for D3 level for Aggregate Data (Surat, Ahmedabad and Vadodara Data)

N	5638		
Median	13.8		
Mode	3		
Min	0.66		
Max	161		
Percentile	Perc	Value	
	8.23	5	Maximum count for first 8.23% of ordered data
	31.74	10	Maximum count for first 31.74% of ordered data
	54.54	15	Maximum count for first 54.54% of ordered data
	69.01	20	Maximum count for first 69.01% of ordered data
	84.9	30	Maximum count for first 84.90% of ordered data
	95.21	50	Maximum count for first 95.21% of ordered data
	99.44	100.596	Maximum count for first 99.44% of ordered data
	99.87	149	Maximum count for first 99.87% of ordered data
	99.88	151.798	Maximum count for first 99.88% of ordered data

Sex wise comparison

Table 7 (A) Sex wise % of persons (Excluding Ahmedabad)

Level of D3	Indian			IOM			U S Endo.Soc.		
	C	M	F	C	M	F	C	M	F
Severe deficiency	--	--	--	7.32	6.07	8.89	--	--	--
Deficient	25	27.28	32.58	37.80	45.55	46.75	58.54	67.81	69.77
Grey area	-	--	--	13.41	16.18	14.13	--	--	
Insufficient	47.6	57.70	52.41	--	--	--	14.63	17.28	15.22
Sufficient	26.2	14.41	14.48	31.71	28.38	25.38	26.83	14.74	14.90
Toxic	1.2	0.61	0.53	9.76	3.81	4.85	0.00	0.17	0.11



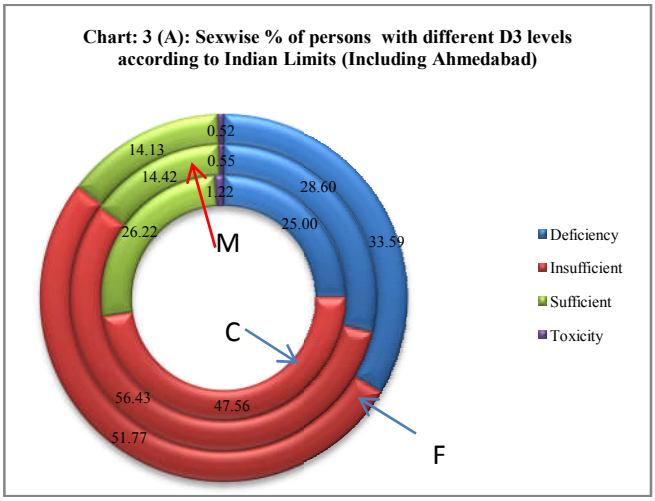


Chart: 2 (B): Sexwise % of persons with different D3 levels according to IOM Limits (Excluding Ahmedabad)

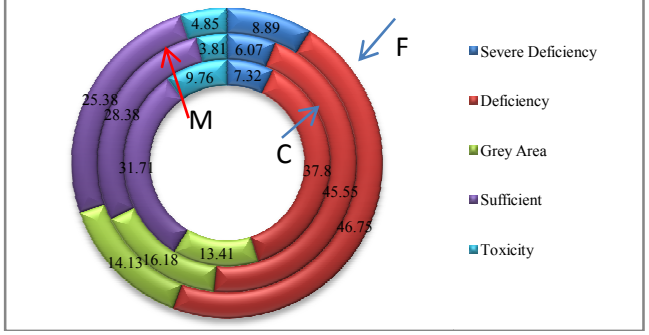


Chart: 3 (B): Sexwise % of persons with different D3 levels according to IOM Limits (Including Ahmedabad)

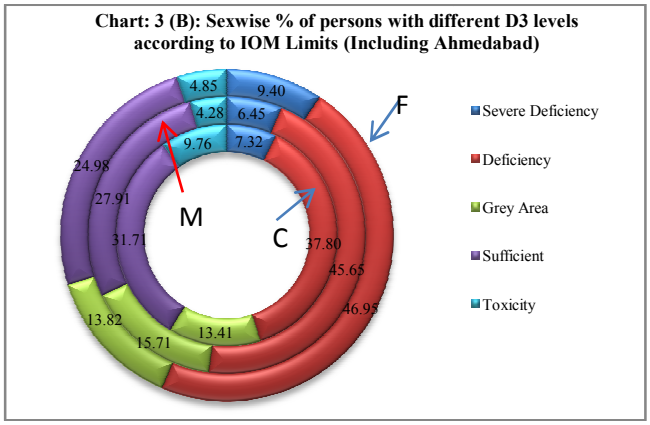


Chart: 2 (C): Sexwise % of persons with different D3 levels according with US Endocrine limits (Excluding Ahmedabad)

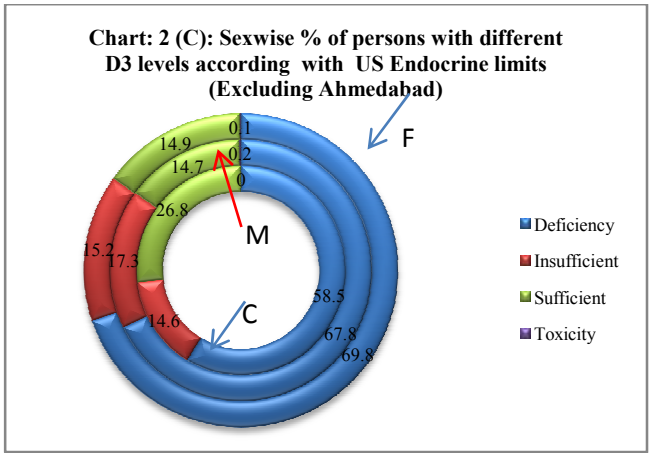


Chart: 3 (C): Sexwise % of persons with different D3 levels according with US Endocrine limits (Including Ahmedabad)

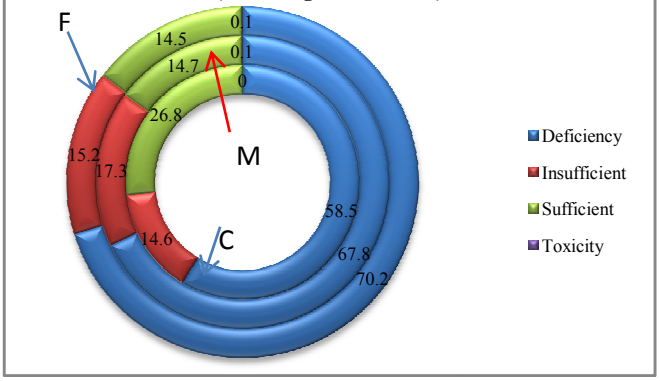


Table 7 (B) Sex wise % of persons (Including Ahmedabad)

Level of D3	Indian			IOM			U S Endo.Soc.		
	C	M	F	C	M	F	C	M	F
Severe deficiency	--	--	--	7.32	6.45	9.40	--	--	--
Deficient	25.00	28.60	33.59	37.80	45.65	46.95	58.54	67.80	70.17
Grey area	--	--	--	13.41	15.71	13.82	--	--	--
Insufficient	47.56	56.43	51.77	--	--	--	14.63	17.32	15.19
Sufficient	26.22	14.42	14.13	31.71	27.91	24.98	26.83	14.74	14.55
Toxic	1.22	0.55	0.52	9.76	4.28	4.85	0.00	0.14	0.09

Age wise comparison

Table 8 Age group wise% ofpersonsin different D3 level for aggregate data

Level of D3	Indian			IOM			U S Endo.Soc.		
	C	A	SC	C	A	SC	C	A	S C
Severe deficiency	--	--	--	7.32	7.91	7.40	--	--	--
Deficient	25.00	32.30	24.09	37.80	49.57	34.35	58.54	72.34	56.96
Grey area	--	--	--	13.41	14.86	15.20	--	--	--
Insufficient	47.56	55.07	52.32	--	--	--	14.63	15.08	19.45
Sufficient	26.22	12.14	22.80	31.71	24.03	35.64	26.83	12.55	23.10
Toxic	1.22	0.49	0.79	9.76	3.63	7.40	0.00	0.03	0.49

Chart: 4 (A): Age wise % of persons with different D3 levels according to Indian limits

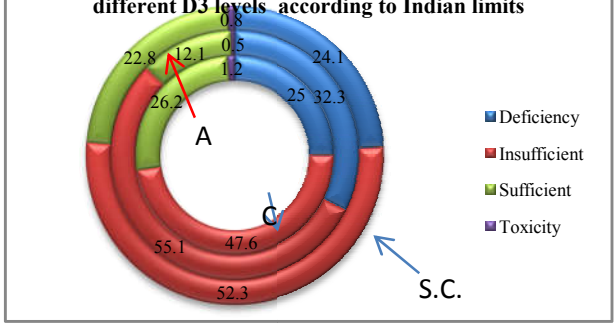


Chart: 4 (B): Age wise % of persons with different D3 levels according to IOM limits

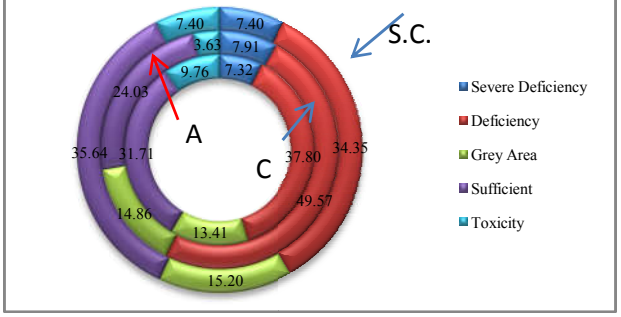
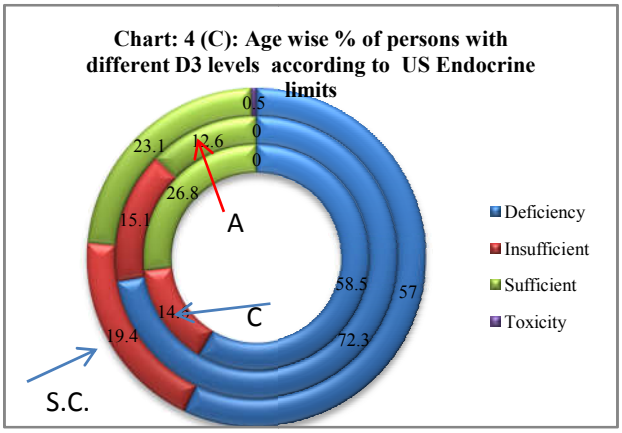


Chart: 4 (C): Age wise % of persons with different D3 levels according to US Endocrine limits



Comparisons of aggregate data on the basis of inferential statistics

1. For aggregate data of all three cities, there is Statistically significant difference between age wise D3 level for IOM, Indian lab as well as US Endocrine limits
2. For aggregate data of all three cities, there is Statistically significant difference between sex wise D3 level for IOM, Indian lab as well as US Endocrine limits

Future Limits

Findings

For population with aggregate data of all three cities using 95% confidence interval through IOM limits (non parametric) it is estimated that 66.01% to71.93% persons, in the entire population, will be below sufficient level, 66.32% to 74.16% females will be below sufficient level, 63.19% to 72.64% males will be below sufficient level and 42.8% to 77.73% children will be below sufficient level of D3. As per the age group analysis 68.71% to 76.10% Adults will be below sufficient

Table 9 Confidence limits (in %) for different levelsof D3 for aggregate data (Including Ahmedabad)

Level of D3	Indian				IOM				US Endo			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.					7.51	8.96	7.5	8.93				
Deficient	30.24	32.68	30.24	32.66	44.88	47.5	44.89	47.49	67.7	70.13	67.72	70.13
Grey area					13.62	15.47	13.61	15.45				
Insufficient	52.11	54.73	52.12	54.73					15.05	16.98	15.04	16.96
Sufficient	13.67	15.53	13.66	15.5	25.16	27.47	25.15	27.45	14.05	15.93	14.04	15.9
Toxic	0.37	0.78	0.36	0.74	4.23	5.36	4.21	5.33	0.04	0.23	0.02	0.19

Table 10 Age Wise Confidence limits (in%) for different levels of D3 for aggregate data (Including Ahmedabad)

Level of D3	limits used by Indian labs											
	Child				Adults				Senior Citizens			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.												
Deficient	18.58	32.35	18.37	31.63	30.78	33.85	30.78	33.82	21.48	26.84	21.45	26.72
Grey area												
Insufficient	39.72	55.49	39.92	55.20	53.43	56.69	53.45	56.68	49.19	55.43	49.24	55.40
Sufficient	19.67	33.65	19.49	32.95	11.10	13.24	11.08	13.20	20.25	25.51	20.22	25.39
Toxic	0.15	4.34	0.00	2.90	0.29	0.78	0.27	0.72	0.34	1.55	0.24	1.33

Table 11 Age Wise Confidence limits (in %) for different levels of D3 for aggregate data (Including Ahmedabad)

Level of D3	IOM											
	Child				Adults				Senior Citizens			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.	3.84	12.43	3.33	11.30	7.05	8.83	7.03	8.79	5.87	9.19	5.79	9.02
Deficient	30.36	45.70	30.38	45.23	47.94	51.21	47.95	51.20	31.43	37.37	31.43	37.28
Grey area	8.60	19.60	8.20	18.63	13.72	16.06	13.70	16.01	13.05	17.56	12.99	17.41
Insufficient												
Sufficient	24.67	39.42	24.59	38.83	22.65	25.45	22.64	25.42	32.68	38.67	32.69	38.59
Toxic	5.68	15.36	5.21	14.30	3.04	4.28	3.02	4.23	5.87	9.19	5.79	9.02

Table 12 Age Wise Confidence limits(in %) for different levels of D3 for aggregate data (Including Ahmedabad)

Level of D3	U S Endocrine society											
	Child				Adults				Senior Citizens			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.												
Deficient	50.59	66.16	51.00	66.08	70.86	73.79	70.89	73.80	53.84	60.03	53.91	60.01
Grey area												
Insufficient	9.61	20.99	9.22	20.04	13.93	16.28	13.92	16.24	17.05	22.02	17.01	21.88
Sufficient	20.22	34.30	20.05	33.61	11.49	13.67	11.48	13.63	20.54	25.82	20.50	25.70
Toxic	0.00	2.22	0.00	0.00	0.00	0.15	0.00	0.08	0.16	1.15	0.06	0.93

Table 13 Sex Wise Confidence limits (in%) for different levels of D3 for aggregate data (Including Ahmedabad)

Level of D3	limits used by Indian labs											
	Child				Male				Female			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.												
Deficient	18.58	32.35	18.37	31.63	26.71	30.56	26.70	30.51	31.97	35.23	31.97	35.20
Grey area												
Insufficient	39.72	55.49	39.92	55.20	54.31	58.52	54.34	58.51	50.05	53.49	50.07	53.48
Sufficient	19.67	33.65	19.49	32.95	12.97	15.97	12.94	15.89	12.95	15.36	12.94	15.31
Toxic	0.15	4.34	0.00	2.90	0.29	0.96	0.24	0.86	0.30	0.82	0.27	0.76

Table 14 Sex Wise Confidence limits (in%) for different levels of D3 for aggregate data (Including Ahmedabad)

Level of D3	IOM											
	Child				Male				Female			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.	3.84	12.43	3.33	11.30	5.45	7.56	5.42	7.48	8.42	10.44	8.40	10.39
Deficient	30.36	45.70	30.38	45.23	43.54	47.77	43.55	47.74	45.24	48.67	45.25	48.66
Grey area	8.60	19.60	8.20	18.63	14.20	17.31	14.18	17.24	12.66	15.05	12.64	15.00
Insufficient												
Sufficient	24.67	39.42	24.59	38.83	26.03	29.85	26.03	29.80	23.51	26.49	23.50	26.45
Toxic	5.68	15.36	5.21	14.30	3.47	5.22	3.43	5.14	4.14	5.64	4.12	5.58

Table 15 Sex Wise Confidence limits (in%) for different levels of D3 for aggregate data (Including Ahmedabad)

Level of D3	U S Endocrine society											
	Child				Male				Female			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.												
Deficient	50.59	66.16	51.00	66.08	65.79	69.77	65.84	69.77	68.58	71.73	68.61	71.73
Grey area												
Insufficient	9.61	20.99	9.22	20.04	15.75	18.98	15.73	18.91	13.98	16.46	13.96	16.41
Sufficient	20.22	34.30	20.05	33.61	13.27	16.30	13.25	16.23	13.36	15.80	13.35	15.75
Toxic	0.00	2.22	0.00	0.00	0.03	0.40	-0.02	0.29	0.02	0.27	-0.01	0.19

Table 16 Sex Wise Confidence limits (in%) for different levels of D3 for aggregate data (Excluding Ahmedabad)

Level of D3	limits used by Indian labs											
	Child				Male				Female			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.												
Deficient	18.58	32.35	18.37	31.63	25.24	29.39	25.23	29.33	30.86	34.34	30.86	34.31
Grey area												
Insufficient	39.72	55.49	39.92	55.20	55.39	59.99	55.43	59.98	50.55	54.26	50.57	54.24
Sufficient	19.67	33.65	19.49	32.95	12.83	16.11	12.79	16.03	13.21	15.83	13.19	15.77
Toxic	0.15	4.34	0.00	2.90	0.30	1.08	0.25	0.97	0.30	0.87	0.26	0.79

Table 17 Sex Wise Confidence limits (in%) for different levels of D3 for aggregate data (Excluding Ahmedabad)

Level of D3	IOM											
	Child				Male				Female			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.	3.84	12.43	3.33	11.30	5.02	7.27	4.97	7.17	7.87	10.00	7.85	9.94
Deficient	30.36	45.70	30.38	45.23	43.24	47.88	43.26	47.85	44.90	48.60	44.92	48.58
Grey area	8.60	19.60	8.20	18.63	14.51	17.96	14.48	17.87	12.87	15.46	12.85	15.41
Insufficient												
Sufficient	24.67	39.42	24.59	38.83	26.31	30.52	26.31	30.46	23.79	27.02	23.78	26.98
Toxic	5.68	15.36	5.21	14.30	2.98	4.80	2.93	4.69	4.09	5.71	4.06	5.64

Table 18 Sex Wise Confidence limits (in%) for different levels of D3 for aggregate data (Excluding Ahmedabad)

Level of D3	U S Endocrine society											
	Child				Male				Female			
	NP		P		NP		P		NP		P	
	LL	U L	LL	U L	LL	UL	LL	UL	LL	UL	LL	UL
Severe defi.												
Deficient	50.59	66.16	51.00	66.08	65.60	69.96	65.66	69.96	68.05	71.46	68.08	71.46
Grey area												
Insufficient	9.61	20.99	9.22	20.04	15.57	19.10	15.54	19.02	13.92	16.59	13.90	16.54
Sufficient	20.22	34.30	20.05	33.61	13.14	16.46	13.11	16.38	13.61	16.27	13.59	16.21
Toxic	0.00	2.22	0.00	0.00	0.03	0.48	0.00	0.35	0.02	0.31	-0.01	0.22

level and 50.35% to 64.12% senior citizens will be below sufficient level of D3. For population with aggregate data of all three cities using 95% confidence interval through Indian lab limits (non parametric) it is estimated that 82.35% to 87.41% persons, in the entire population, will be below sufficient level, 82.02% to 88.72% females will be below sufficient level, 81.02% to 89.08% males will be below sufficient level and 58.3% to 87.84% children will be below sufficient level of D3.

As per the age group analysis 84.21% to 90.54% Adults will be below sufficient level and 70.67% to 82.27% senior citizens will be below sufficient level of D3.

For population with aggregate data of all three cities using 95% confidence interval through Indian lab limits (non parametric) it is estimated that 82.75% to 87.11% persons, in the entire population, will be below sufficient level, 82.56% to 88.19%

females will be below sufficient level, 81.54% to 88.75% males will be below sufficient level and 60.2% to 87.15% children will be below sufficient level of D3. As per the age group analysis 84.79% to 90.07% Adults will be below sufficient level and 70.89% to 82.05% senior citizens will be below sufficient level of D3.

It can be seen that in any of the three limits, Children have less deficiency than adults and senior citizens.

Necessity and Scope of further study

In present paper only vitamin D3 deficiency is measured using different limits. Vitamin D3 plays an important role in chronic disease. So before treatment of any chronic disease vitamin D3 supplements should be given. With the data of vitaminD3, parathyroid hormone (PTH), protein, Charlson index, hemoglobin level, renal function can be collected. We can find any relationship between specified parameters and establish regression model.

Acknowledgement

We are thankful to all laboratories who provided us the data of vitamin D3.

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Web Resources

http://www.healingtherapies.info/sunlight&vitamind.htm

How to cite this article:

Shah H. M., Rajyaguru A. J and Kazi G.2018, Vitamin D: Reality or Hype?: A Case Study of Combined Data of Surat, Ahmedabad and Vadodaracity. *Int J Recent Sci Res.* 9(1), pp. 23420-23426.
DOI: http://dx.doi.org/10.24327/ijrsr.2018.0901.1465

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