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Presentations of Vitamin D Deficiency and Serum Level of 25-Hydroxycholicalciferol

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Abstract: Many research articles have reported that large proportions of people are "deficient" in vitamin D, as many of them have serum concentrations of vitamin D (i.e., 25-hydroxyvitamin D [25(OH)D]) below 20 ng/ml (50 nmol/l). Such conclusions, however, are based on misinterpretation and misapplication of the Institute of Medicine (IOM) reference values for vitamin D. Such misunderstandings can have adverse implications for patient care, including unnecessary vitamin D screening and supplementation. To assess the prevalence of vitamin D status among apparently healthy Saudi population, living in Makkah, one of the most shinny city in the world, our study included 651 apparently normal subjects living in Makkah. Serum 25(OH) cholecalciferol, parathormone (PTH), Serum calcium, phosphorus, alkaline phosphatase, glucose, urea, creatinine and albumin were assayed. In a second phase: We analyzed the data of 332 asymptomatic subjects who are completely apparently normal and have no symptoms or signs of vitamin D deficiency or any associated diseases and excluded others. The obtained results showed that 84.2% of the study subjects have serum concentrations of vitamin D (i.e., 25 -hydroxyvitamin D [25(OH)D]) below 20 ng/ml and 47% were below 10 ng/ml, 73.9% were less than 15 ng/ml and 90.5 were less than 25 ng/ml. We concluded that the outstanding low level of vitamin D in our study sample represents the accumulated effects of these factors on vitamin D as store in the body, but not the status and activity of the vitamin as most of our sample subjects are healthy and free of signs and symptoms of frank vitamin D deficiency in spite of its low serum level. Although the 25-(OH)D is a 1gold standard test for diagnosing vitamin D deficiency, several problems affect its utility. Ultimately, it seems that we may be placing more trust in the test than it yet deserves. There is an urgent need to revise the concept related to vitamin D assays for our healthy persons and patients in order to determine exactly who is in need for vitamin D supplementation or therapy or correction of life style by increasing exposure to sun rays is sufficient.

Key words: Vitamin D Deficiency · Hypovitaminosis D · Rickets · Osteoporosis

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INTRODUCTION

Vitamin D insufficiency or deficiency is an epidemic and a common problem worldwide, even affecting healthy population. Only a small amount of vitamin D is obtained from the diet, since it is contained in only a few food sources. Most of the needed vitamin D is derived from the synthesis of cholecalciferol (vitamin D3) in the skin from 7-dehydrocholesterol stored under the skin through exposure to sunlight [1]. Once vitamin D3 is produced in the skin or consumed in food, it is converted in the liver to 25-hydroxyvitamin D3 [25(OH) D3] by vitamin D-25-hydroxylase [2]. A second hydroxylation to the main physiologically active metabolite, 1,25-dihydroxyvitamin D [1,25(OH)2D3], occurs predominantly in the kidney through the action of 1-alpha-hydroxylase[3] .This process is regulated by parathyroid hormone (PTH), calcitonin, calcium, phosphorus, as well as by 1,25(OH)2D3 itself [4] . After 1,25 (OH)2D3 is synthesized it is transferred to its target tissues by binding to vitamin D binding protein (DBP)[5]. The accepted way to determine vitamin D nutritional status is by measurement of the level of 25(OH)D3, which has a slower rate of clearance (biological half life of approximately 3 weeks) as compared to vitamin D3 (approximately 24 h) and 1,25(OH)2D3 (approximately 4–6 h)[6].

Vitamin D is mandatory for the maintenance of health. It has also recently been found that its highly specific receptors, vitamin D receptors (VDRs) is present in a variety of cells thus it has a biological effect on more than mineral metabolism and a regulatory role in the encoding of more than 200 genes, thus deficiency of vitamin D could affect any tissue or body system[7].

Vitamin D deficiency can result from inadequate irradiation of the skin, insufficient dietary intake of the vitamin, or impairments in metabolic activation (hydroxylation) of the vitamin[8]. Other factors potentially affect vitamin D status include genetic factors, adiposity and factors affecting the cutaneous synthesis of vitamin D such as skin pigmentation, age, season, latitude, melanin concentration, clothing and use of sunscreens[9].

Despite the ongoing controversy regarding the definition of vitamin D deficiency, the most widely accepted definition is a serum level of 25(OH)D < 20 ng/ml; levels between 20 and 29 ng/ml are considered insufficient and levels ≥ 30 ng/ml are considered sufficient. This definition is based on the facts that: serum 25(OH)D levels are inversely associated with parathyroid hormone levels until the former reach 30–40 ng/ml, at which point parathyroid hormone levels begin to level off [10] and intestinal calcium transport increased 45–65% in women when 25(OH)D levels increased from an average of 20 ng/ml to an average of 32 ng/ml [11].

Vitamin D inadequacy can be seen in young adults as well as healthy children. Vitamin D deficiency is often a silent disease. By definition, rickets occurs in children whose growth plates have not fused. These children are often found to have started walking late or prefer to sit down for prolonged periods. In adults, vitamin D deficiency results in osteomalacia, which presents as a poorly mineralized skeletal matrix[12].

Despite the sunshine, Middle Eastern populations showed a high rate of low vitamin D due to limited sun exposure based on cultural practices[13, 14]. Despite hypovitaminosis D is a critical health problem, limited studies on vitamin D status in Arab countries have been performed. In 2005, Masri and his colleagues reported that 33.5% of Jordanian women sample of 821 aged 20 to 89 years had vitamin D deficiency and 50.3% of the sample had vitamin D insufficiency [15]. In 2012 and in agreement with the previous study, El-Menyar *et al.*[16] substantiated the evidence of a widespread prevalence of low vitamin D in Qatar , a sunny rich country.

The prevalence of vitamin D deficiency in children living in Jeddah was 72.55%; males were 43.14% and females were 56.86%, having a statistically significant higher incidence of 25(OH)D deficiency[16].

Fuleihan and Deeb [14] measured serum 25-hydroxyvitamin D and parathyroid hormone during the summer in random sample of 465 women from a village in central Lebanon. The mean serum concentration of 25-hydroxyvitamin D was 11 ng/ml. Sixty percent of the women had concentrations of less than 10 ng/ml, 35% had concentrations between 10 and 20 ng/ml and only 5% had concentrations greater than 20 ng/ml. The mean serum concentration of parathyroid hormone was 31pg/ml. Their data demonstrated that a substantial number of healthy young women in central Lebanon had vitamin D insufficiency in the summer, despite the lack of symptoms. In the elderly Lebanese, 37% of males and 56% of females had vitamin D levels < 25 nmol/L[14]. Similarly, in an international study conducted in females with osteoporosis, the highest proportion of low vitamin D was noticed in the Middle East[17].

Studies conducted between 1982-1992 showed that vitamin D levels in ethnic Saudi citizens were lower than rest of the world. In 2003, Al-Fajar and Al-Mutairi [19] reported a prevalence of low vitamin D levels in 83% of patients presenting with backache. Studies association of vitamin D and osteoporosis has brought vitamin D in the

limelight again [18]. In addition, vitamin D deficiency study has been applied among healthy Saudi women living in eastern province. It has been found that vitamin D deficiency among healthy young Saudi women of 25-35 years was 33% and 50% in women of ≥ 50 years. This study indicated that hypovitaminosis D is common in young and menopausal women [19].

The relation between Vitamin D level and body mass density (BMD) is still debatable. As vitamin D deficiency leads to defective bone mineralization and low bone mass, many researchers studied the relationship between BMD and vitamin D serum level. Some studies suggest that a low level of vitamin D is associated with low BMD, while other studies found no such association.

Such conclusions, however, are based on misinterpretation and misapplication of the Institute of Medicine (IOM) reference values for vitamin D. Such misunderstandings can have adverse implications for patient care, including unnecessary vitamin D screening and supplementation.

As low serum vitamin D levels are common even in sunny countries, therefore the objectives of this study were to assess the prevalence of vitamin D status among apparently healthy Saudi population, both male and female living in Makkah, one of the most shinny city in the world and to highlight answers for some of the ongoing controversy regarding vitamin D deficiency.

Subjects and Methods: This is a descriptive, analytical and cross-sectional study carried out in the Faculty of Medicine, Umm Al-Qura University in the period of October 2014 to October 2017. The study was approved by the faculty ethics committee. All participants gave informed consent in accordance with the declaration of Helsinki.

The study sample included 651 subjects selected from apparently healthy asymptomatic adult Saudi male and female individuals living in Makkah with normal style of life including:

- Healthy school Saudi students their age ranges from 12-18 years, recruited from health care clinical unit present in their schools.
- Healthy Saudi population from Umm Al-Qura University, involving bothstudents (19-24 y) and staff members (30-50 y) & their relatives. We tried to select asymptomatic individuals and excluded diseased persons at any level as much as we could. Persons with frank symptoms or signs of vitamin D deficiency, neurological disorders, digestive disturbances and chronic diseases were excluded from the study.

Full history taking and complete medical examination was performed to all participants by our young medical staff including heart, chest, abdominal, orthopedic and neurological examination. As well, anthropometric measurements were recorded. In addition to the clinical examination, participants were given a full designed questionnaire, addressing their clinical history, frequency of sun exposure, daily intake of dairy products, history of vitamin D or calcium supplementation, history of bone aches or pains and intake of any medications that could affect vitamin D metabolism.

10 ml of whole venous blood samples were withdrawn from each participant, collected in a red labeled plain tubes. The blood samples are allowed to clot for 15 min then centrifuged for 20 minutes on 3500 rpm at -5°C for separation of serum.

The following parameters were assayed:

- Serum 25(OH) cholecalciferol and parathormone (PTH**)** were measured by electrochemiluminescence binding assay on Cobas immunoassay analyzer.
- Serum calcium, phosphorus, alkaline phosphatase, glucose, urea, creatinine and albumin were analysed on Cobas chemistry autoanalyzer.

One limitation of this study is that some factors that may have led to mild vitamin D deficiency in other parts in Saudi Arabia were not examined such as dietary deficiency with increased demands.

Statistical Analysis: Data obtained from the study were coded and entered using the statistical package SPSS version 16. The mean values, standard deviation (SD) and ranges were then estimated for quantitative variables, as for the qualitative variables, the frequency distribution was calculated. The correlations between individual variables were calculated using Pearson correlation coefficient. P values less than 0.05 and less than 0.005 were considered statistically significant and highly significant, respectively.

RESULTS

The present study included 651 cases. All of them were apparently normal subjects living in Makkah. Their age ranged between 9 and 75 years. 45% were 9 –27 years, 55% their age ranged between 27 and 55 years (Fig. 1). 358 (55%) were males and 298 (45%) were females.

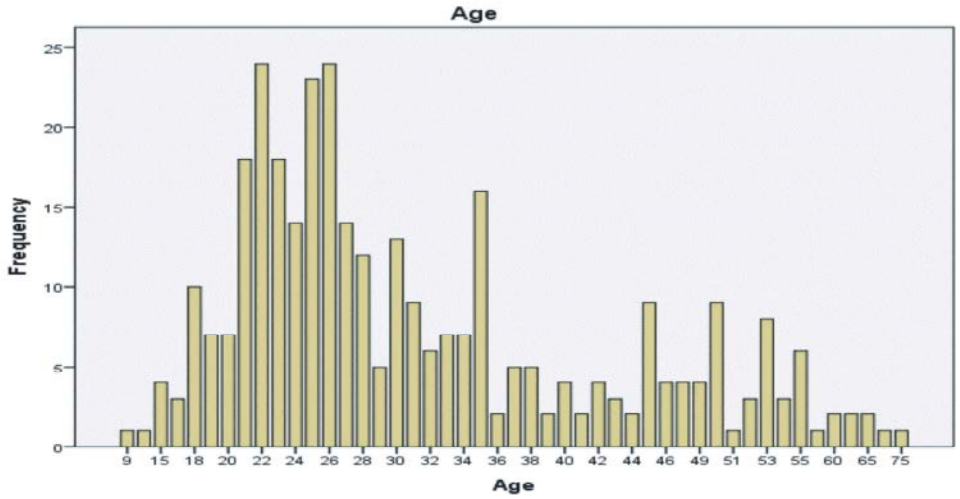

Fig. 1: Frequency of age of all participants

Table 1: The descriptive analysis of the obtained results in all examined individuals (651 subjects)

variables	Unit	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Vit D	ng/ml	13.09	9.09	.356	3.00	70.25
PTH	pg/ml	47.81	25.20	.988	4	332
Glucose	mg/dl	86.14	54.26	2.15	71	176
Urea	mg/dl	28.88	15.00	.594	10	214
Creatinine	mg/dl	.888	.427	.0169	0.49	1.61
Calcium	mg/dl	9.50	1.03	.0409	7.1	12.6
Phosphorus	mg/dl	4.20	1.28	.0519	3.1	16.7
ALP	U/l	74.4	35.0	1.39	9	512
Albumin	g/dl	4.73	.58	.023	1.8	6.4
BMI	(kg/ m^2)	26.3	6.1	.345	19.4	50.9

Table 2: Frequency of Vitamin D, PTH, Calcium, Phosphorus and Alkaline phosphatase levels in all individuals studied (651 subjects)

Vitamin D level (ng/ml)												
Vitamin D level	<5	<10	<15	<20	<25	<30	<35	<40	<45	<50	<60	<70
Cumulative %	6.9	47	73.9	84.2	90.5	94.3	96.2	97.8	98.8	99.4	99.7	100
PTH level (pg/ml)												
PTH level	<25		<35		<45		<55		<65		<75	75 – 332
Cumulative %	10.8		29.3		50.4		71.3		83.4		90.9	9.1
Calcium level (mg/ml)												
Calcium level	<7	<7.5	<8	<8.5	<9	<9.5	<10	<10.5	<11	<12.5		
Cumulative %	2	3.5	6.6	11	23.6	43.5	65.2	86.8	96.7	99.8		
Phosphorus level (mg/ml)												
Phosphorus level	<2.5	<3	<3.5	<4	<4.5	<5	<5.5	<6	<6.5	>6.5		
Cumulative %	2	9	20.2	45	71.3	85.6	92.7	95.1	95.8	4.2		
Alkaline phosphatase level (U/l)												
Alkaline phosphatase level	<50		<75		<100		<125		<130		130 and more	
Cumulative %	15.1		62.1		85.6		94.6		95.1		4.9	

Frequency of Vitamin D, PTH, Calcium, Phosphorus and Alkaline phosphatase levels in all individuals studied (651 subjects) are illustrated it table (2) And Fig. 2.

The obtained results of the biochemical assays of the blood samples are illustrated in Table (1).

The obtained results summarized in Table 2 indicate that:

Vitamin D: 47% were □10 ng/ml, 73.9% were □15 ng/ml , 84.8% were □ 20 ng/ml and 90.5% were □25 ng/ml.

PTH Level: about 90 % of cases are below 75 pg/ml, only 9.1 % is above 75 pg/ml

Calcium Level: About 80 % of cases are in normal range (8 – 10.5 mg/dl). 11% were below 8 mg/dl and about 4% above 11 mg/dl .

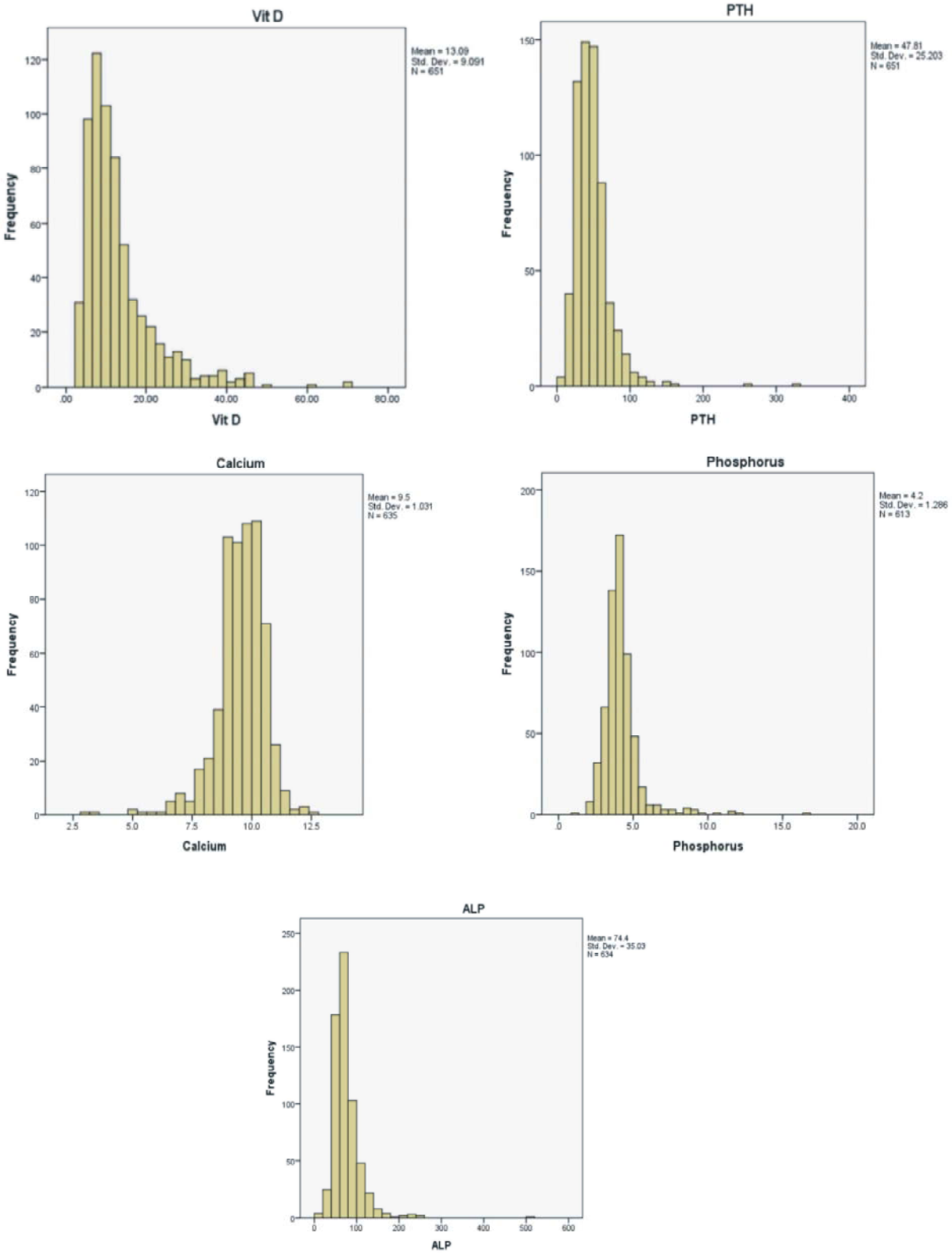

Fig. 2: Frequency of Vitamin D, PTH, Calcium, Phosphorus and Alkaline phosphatase levels in all individuals studied (651 subjects).

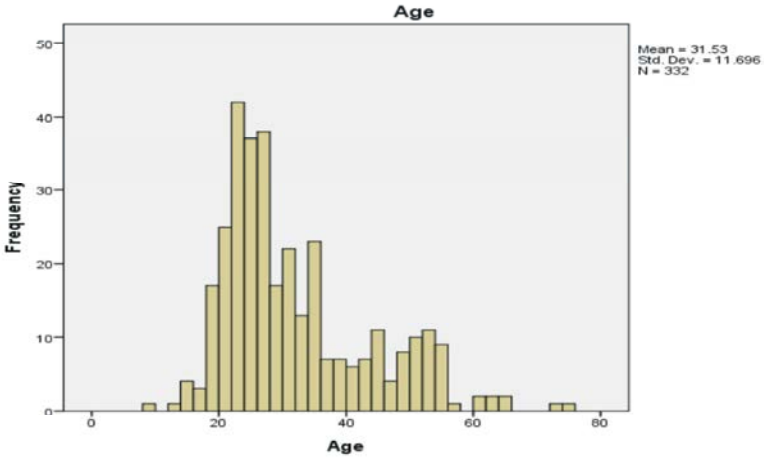

Fig. 3: Frequency of age of the selected participants (332 subjects)

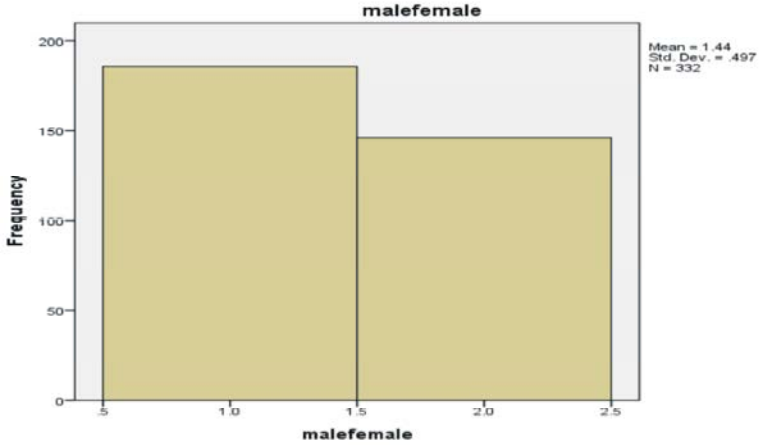

Fig. 4: Male and female percentages of the selected participants (332 subjects)

Table 3: The frequency of disease symptoms in all studied individuals

Disease symptoms	%	Cumulative %
No symptoms	50.5	50.5
Mild nonspecific Back pain	3.5	54.0
Joint pains	10.8	64.8
Muscle twitching	1.5	66.3
Muscle aches and weakness	11.4	77.7
Fatigability and tiredness	9.6	87.3
Others	12.7	100

Phosphorus Level: About 72 % of cases were in normal range (3.5 – 5.5 mg/dl), 9% were below 3 mg/dl and about 15 % above 5 mg/dl.

Alkaline Phosphatase Level: 80% of cases were in the range of 75– 130 U/l , 15% were below 50 U/l and only 5 % were above 130 U/l.

- On revising patient data and examination sheets, we noticed that some of them still have a history of symptoms that may be related to any associated disease.
- We revised our patient files and excluded those individuals with any sign or symptoms related to vitamin D deficiency.
- We selected those individuals who were completely asymptomatic and with free medical examination.

We found that 50.5 % of participants had no symptoms or signs famous for vitamin D deficiency. Others may have one or two of general symptoms (Table 3).

In a Second Phase: We analyzed the data of those asymptomatic adults who were apparently normal and have no symptoms or signs of vitamin D deficiency or any associated diseases and excluded others. We got 332 subjects fulfilling these new inclusion criteria. Our selected sample included 186 male (56%) and 146 females (44%) most of them (75%) are in the age range of 20 to 45 years as shown in Figs. 3 & 4.

Table 4: The obtained results of the highly selected participants (332 subjects)

Parameters	Mean	Minimum	Maximum	Standard Error	Standard Deviation
Length	165.6	135	190	0.54	9.58
Weight	72.6	62	165	1.08	19.17
BMI	26.4	19.4	50.9	0.355	6.297
Waist	68.6	100	155	1.86	29.34
Vitamin D	13.25	3.0	70.0	0.506	9.22
PTH	47.69	11	265	1.3	23.73
Glucose	89.4	75	116	3.27	59.46
Urea	28.4	11	52	0.64	11.58
Creatinine	0.91	0.38	1.368	0.015	0.272
Calcium	9.66	7.1	12.6	0.055	0.998
Phosphorus	4.21	1.1	16.7	0.078	1.38
ALP	77.9	9	512	2.26	40.98
Albumin	4.84	3.3	6.4	0.028	0.505

Table 5: The frequency of vitamin D, PTH, calcium, phosphorus and alkaline phosphatase levels in studied selected individuals (332 subjects)

Vitamin D level (ng/ml)										
Vitamin D level	<5	<10	<15	<20	<25	<30	<35	<40	<50	<70
Cumulative %	8.1	47.9	72.6	82.8	90.1	93.7	95.8	97.6	99.4	100
PTH level (pg/ml)										
PTH level	<25	<35	<45	<55	<65	<75	75 – 265			
Cumulative %	12.3	31	53.3	73.2	84.9	90.7	9.3			
Calcium level (mg/ml)										
Calcium level	<7.5	<8	<8.5	<9	<9.5	<10	<10.5	<11	<12.5	
Cumulative %	1.8	3.3	7.6	22.2	42.9	65.7	86	95.4	100	
Phosphorus level (mg/ml)										
Phosphorus level	<2.5	<3	<3.5	<4	<4.5	<5	<5.5	<6	<6.5	>6.5
Cumulative %	1.9	8.9	22.6	51.3	76.8	91.4	93.9	94.6	95.9	4.1
Alkaline phosphatase level (U/l)										
Alkaline phosphatase level	<50	<75	<100	<130	130 and more					
Cumulative %	13.4	61.6	85.4	93.3	6.7					

Regarding serum vitamin D in the selected individuals group, 47.9 % were less than 10 ng/ml, 72.6 % were less than 15 ng/ml, 82.8% were less than 20 ng/ml and 90.1% were less than 25 ng/ml.

Regarding serum parathormone levels in the selected individuals group, 84.9 % of cases are below 65 pg/ml and only 15.1 % is above 65 pg/ml

Calcium level is the normal range (8 – 10.5 mg/dl) in about 82.7 % of cases.

Only 3.3 % is below 8 mg/dl and about 14 % above 11mg/dl.

Phosphorus level is the normal range (3.5 – 5.5 mg/dl) in about 71.3 % of cases.

8.9% is below 3 mg/dl and 6.1 % above 5.5

90% of Alkaline Phosphatase enzyme level is the range of 35–130 U/l.

3 % of cases are below 35 U/l of and only 6.7 % are above 130 U/l.

Table (4) illustrates the obtained results of the biochemical assays of the highly selected participants (332 subjects). The frequency of vitamin D, PTH, calcium, phosphorus and alkaline phosphatase levels in selected individuals studied (332 subjects) are illustrated in Table (5) and Fig. 5.

There is a significant correlation between Vitamin D, PTH, Calcium, Phosphorus and Alkaline phosphatase levels in highly selected individuals' samples as shown in Table (6).

Comparing the results of those selected asymptomatic healthy persons (332 subjects) with the results obtained for the whole sample (651 subjects) we found that there is no prominent variation and we can get the same conclusion regarding the low level of vitamin D with nearly normal levels of parathormone hormone, calcium, phosphorus and alkaline phosphatase (Table 7).

DISCUSSION

Vitamin D deficiency or insufficiency affects 1 billion people worldwide that even in the developed countries and healthy population, as deduced from several studies

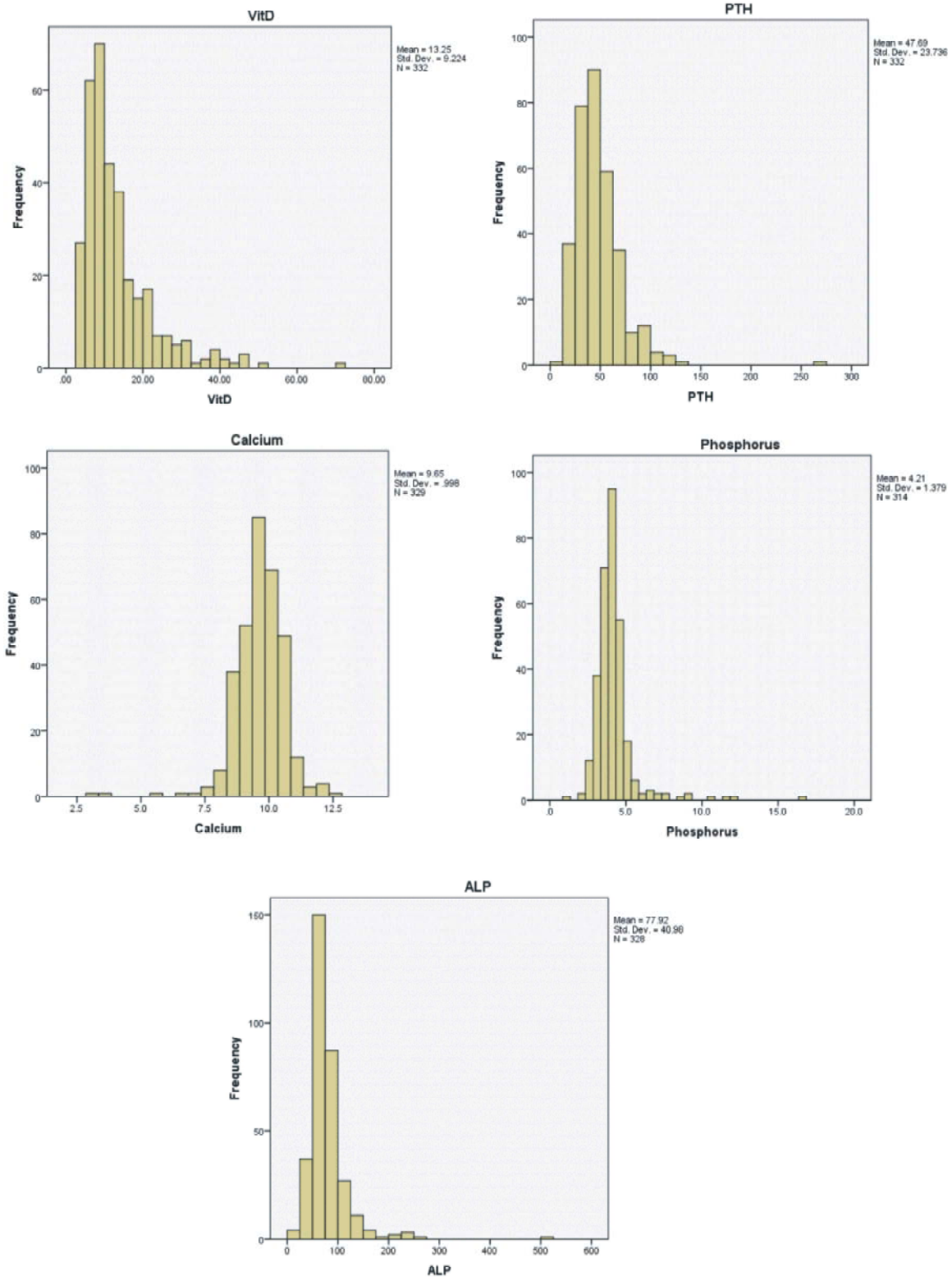

Fig. 5: Frequency of Vitamin D, PTH, Calcium, Phosphorus and Alkaline phosphatase levels in the studied highly selected individuals (332 subjects).

Table 6: The correlation between the different parameters studied (Edit table with Times New Roman)

		Vit D	PTH	Calcium	Phosphorus	ALP
VitD	R	1	-.266-**	.151**	.001	-.049-
	P		.000	.006	.982	.373
PTH	R	-.266-**	1	-.272-**	-.187-**	.113*
	P	.000		.000	.001	.041
Calcium	R	.151**	-.272-**	1	.056	.156**
	P	.006	.000		.320	.005
Phosphorus	R	.001	-.187-**	.056	1	-.067-
	P	.982	.001	.320		.238
ALP	R	-.049-	.113*	.156**	-.067-	1
	P	.373	.041	.005	.238	

Table 7: The range of vitamin D level in studied whole and selected individuals

Whole sample (651 cases)												
Vitamin D level (ng/ml)	<5	<10	<15	<20	<25	<30	<35	<40	<45	<50	<60	<70
Cumulative %	6.9	47	73.9	84.2	90.5	94.3	96.2	97.8	98.8	99.4	99.7	100
Selected cases (332)												
Vitamin D level (ng/ml)	<5	<10	<15	<20	<25	<30	<35	<40	<50	<70		
Cumulative %	8.1	47.9	72.6	82.8	90.1	93.7	95.8	97.6	99.4	100		

[20, 21]. Although sun exposure is the major source of vitamin D, several reports show that low vitamin D is common in sunny regions [22, 23].

Despite some cultural factors that may negatively affect serum vitamin D levels of Saudi women (e.g. high gravidity and clothing that limits skin exposure to the sun), these factors do not apply to males and hence vitamin D ranges may be expected to be different between males and females. However, the prevalence of 25(OH) D deficiency was high among Saudi Arabians and these 25(OH)3 low levels did not differ significantly between males and females [20]. A hospital-based study in Saudi Arabia of 100 healthy male medical students, interns, residents, physicians and employees aged 25–35 years and 100 healthy male visitors of the same hospital aged ≥ 50 years reported low vitamin D levels, i.e. < 20 ng/ml, in 28% of the first group and in 37% of the second group [24].

To highlight answers for some of the ongoing controversy regarding vitamin D deficiency , we performed our recent study in Umm Al-Qura University in Makkah. In our samples we studied the effects of some major factors affecting vitamin D level on the group of healthy individuals. The variation of the obtained results was illustrated but generally they did change much the grade of the obtained low vitamin D level in that group. The obtained results illustrated that 82.8 % of the healthy people sample have vitamin D level less than 20 ng/ml, while parathormone level is within the normal range (15-65 pg/ml) in 83.1% of the sample, calcium level within the normal range in 95% of the sample, phosphorus is normal in 88.9% and alkaline phosphatase is normal in 93.3% of the included subjects.

- That illustrates that biochemically the decrease in vitamin D level in our subjects is not accompanied by the biochemical changes seen in frank vitamin D deficiency like rickets and osteomalacia.
- It seems that measurement of 25 hydroxy cholecalciferol as indicator of vitamin D deficiency is debatable. It is commonly agreed that vitamin D (25-OH) is the metabolite to determine the overall vitamin D status as it is the major storage form of vitamin D in the human body. This primary circulating form of vitamin D is biologically inactive with levels approximately 1000- fold greater than the circulating1,25-dihydroxyvitaminD and half-life of 2-3 weeks. Routine Laboratory Measuring of 1,*25 (OH) Vitamin D* is difficult because it is 1/1000 of 25 (OH) Vitamin D concentration (represented as pg/ml). It has very short half life (4 – 6 hours only) and no references value can be determined for it.

In the last few months, important published articles were asking: *Vitamin D Deficiency: Is There Really a Pandemic? [25]. Should We Screen for Vitamin D Deficiency?* [26]. *Vitamin D: What is the right level?*. Monique Tello from Harvard Medical School asked very important question: *Vitamin D, "What is the right level?" [25]*. She stated that many of patients ask to have their vitamin D levels checked. Mostly, they want to know that they're doing everything they can to keep their bones

strong. But on checking that blood level, how to act on the result is the subject of great controversy in medical-research land. The venerable Institute of Medicine (IOM) [27] issued a report that a vitamin D level of 20 ng/mL or higher was adequate for good bone health and subsequently a level below 20 was considered as vitamin D deficiency. But the respected Endocrine Society issued a report urging a much higher minimum blood level of vitamin D. They recommend between 40 and 60 ng/mL for both children and adults [28].

In November 2016 an article titled "Vitamin D Deficiency: *Is There Really a Pandemic*?" published in the New England Journal of Medicine reported that several of the leading epidemiologists and endocrinologists argue for a lowering of the currently accepted cutoff level of 20 ng/ml. They feel that we are over-screening for vitamin D deficiency and unnecessarily treating individuals who are perfectly fine. They examined a massive amount of data from the National Health and Nutrition Examination Survey (NHANES) and found that less than 6% of Americans had vitamin D levels less than 12.5. Based on their analysis, a more appropriate cutoff for vitamin D deficiency would be much lower,12.5 ng/mL [25]. A cutoff of 12.5 ng/mL would most certainly eliminate the "pandemic" of vitamin D deficiency.

In practice it is not uncommon to see a vitamin D level less than 20 ng/ml. When that happens, physicians will tell the patients that they are deficient and recommend fairly aggressive replenishment, as well as ongoing supplementation. U.S. Preventive Services Task Force (USPSTF) report [29] concluded that current evidence is insufficient to assess the benefits and harms of screening for vitamin D deficiency in asymptomatic adults. The American Academy of Family Physicians concluded that current evidence regarding vitamin D deficiency screening is insufficient to make a recommendation[30]. Respected osteoporosis experts suggested that we are currently over screening for vitamin D deficiency and over treating people who are getting enough vitamin D through diet and sun exposure. There is no need to be checking the vitamin D levels of most healthy individuals.

To answer this question "who should be screened for vitamin D deficiency?", Most Osteoporosis experts agree we should be checking vitamin D levels in high-risk people — those most at risk for a true deficiency. These include people with anorexia nervosa, people who have had gastric bypass surgeries, who suffer from other malabsorption syndromes like celiac sprue, or who have dark skin. In addition, certain populations will require that vitamin D level of 20 ng/ml or higher. This can include premenopausal women, people diagnosed with osteopenia and osteoporosis or other skeletal disorders, as well as pregnant and lactating women. All of these groups should be screened and treated as appropriate. In short

"Vitamin D has been hyped massively,". "We do not need to be checking the vitamin D levels of most healthy individuals.", "It doesn't make sense that higher vitamin D levels would be beneficial to humans". A common misconception is that nearly the entire population must have a serum 25(OH)D level above 20 ng/ml to achieve good bone health.

CONCLUSIONS

We can conclude that the outstanding low level of vitamin D in our study sample and in all other previous studies done in Saudi Arabia is the result and impact of the prevalent environmental, agricultural and nutritional factors in this area and other similar area in the world. These values represents the accumulated effects of these factors on vitamin D as store in the body, but not the status and activity of the vitamin as most of our sample subjects are healthy and free of signs and symptoms of frank vitamin D deficiency in spite of its low serum level. There is a lot of argument in measuring and considering serum 25(OH) D level as the parameter that reflects vitamin D status of an individual. Measuring 25 (OH) Vitamin D is reflecting only nutritional store of vitamin D, but not the vitamin D status related to clinical presentation. We do not need to be checking the vitamin D levels of most healthy individuals.

Recommendations: We are in urgent need to revise the concept related to vitamin D assays for our healthy persons and patients in order to determine exactly who is in need for vitamin D supplementation or therapy or correction of life style by increasing exposure to sun rays is sufficient.

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