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VITAMIN D DEFICIENCY AMONG THE HEALTHY POPULATION IN LEBANON

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ABSTRACT

Despite ample sunshine, deficiency has long been a *presupposition* when it comes to vitamin D status in almost all countries of the Middle East and North Africa. The aim of this retrospective study is to estimate the prevalence of vitamin D deficiency and to investigate any possible correlation with other physiological parameters including age, sex and calcium serum levels, among the population living in Beirut. Results of Eight hundred thirty-eight individuals, aged between 1 to 80 years, were included in this study. This was achieved using data derived from different large laboratory databases, gathered across a wide temporal window of six years (2011-2016) that included all age groups and both genders. The prevalence of vitamin D deficiency was 61.77% in female and 33.90% in male subjects studied. A significant association is established between Gender and vitamin D deficiency where females are 3 times at higher risk to be deficient than males. The highest prevalence was found in the female age group [30-40 years] while no significant correlation with age was found in males. However, vitamin D deficiency does not show a strong correlation with serum calcium levels. The Prevalence *of* Hypovitaminosis D tends to be pandemic both in Lebanon and other Middle Eastern countries. Further understanding requires additional population-based studies in order to better assess and compare different results.

KEYWORDS: Vitamin D, deficiency, calcium, Lebanon, prevalence.

INTRODUCTION

Vitamin D deficiency remains to be a great deal of a public health problem in the Middle East and North Africa regions, leading to high occurrences of related diseases and malignancies; Osteoporosis as the most predominant(IFO, 2011). Despite the discovery of vitamin D's chemical structure and having supplements widely available, along with the ever continues sunlight that has proven to be the major domino in vitamin D's synthesis, vitamin D deficiency continues to be highly prevalent and so lightly regarded in our sunny countries.

Prevalence of 25(OH) D3 insufficiency ranges between 50% to 90%, depending on the cut-off used (i.e., <20 nmol/ml or <30 nmol/ml) and a population of interest. Countries with the highest prevalence are in Asia in general and the Middle East in particular (Hotiet Maha, 2014) although the Middle East (15°- 36° N) and Africa (35°S-37°N) is mostly hit with ample sunshine, the region registers the highest rates of rickets, a hypovitaminosis D, related disease, world wide (El-Rassi R, 2009). Vitamin D deficiency prevails in these regions with rates varying 30– 90%, considering a desirable serum 25 hydroxyvitamin D [25(OH)D] of 20 ng/ml. (Bassil D, 2013).

This dilemma, approached in so many previous studies and discussed during many related conferences, can in large part, be explained by limited sun exposure due to cultural practices. These are dictated by the area's tight connection to conservative living styles. Among such practices are body covering and veil/hijab-wearing. Furthermore, prolonged breast-feeding, without vitamin D supplementation, due partially to the lack of mandatory medical coverage or awareness, during and after gestation (Bassil D, 2013). In addition, there is the socioeconomic status which has proven to be of influence regarding decreased vitamin D levels are school children of low SES (Carmen Hajj Shahine, 2001).

Serum 25(OH) D3 level is the best index of vitamin D nutritional status, though not the active form. In Lebanon, the cut off usually used is a deficiency for <20 ng/ml or <30ng/ml of blood. In this study, using a cut of <20ng/ml, the focus is put upon the correlation of D3 levels, serum calcium, gender and age of patients shedding more light on the status of hypovitaminosis D in Lebanon's capital Beirut and comparing it to previous studies and drawing out a reliable result.

MATERIALS AND METHODS

Subjects

This retrospective study was performed using data from different laboratory databases in Beirut, of 838 outpatients. The tests taken over a period of six years (2011-2016). The data retrieval was approved by the head boards at each laboratory and conducted with informed consent. The target population comprised individuals aged 1-80 years who have had both vitamin D3 and calcium serum levels tested using the Roche standard kit. Demographic data recorded for everyone included age and gender.

Statistical analysis

Normality of the data distribution was checked by the Kolmogorov-Smirnov test. The Pearson test was used to evaluate a significant correlation between two quantitative variables. The *Chi-Square* test (X^2 test) of Independence is used to determine if there is a significant relationship between two categorical variables. P-Values < 0.05 were considered significant. Statistical analysis was performed using GraphPad Prism software.

RESULTS

A total of 838 subjects were included in this study. Individuals included 721 women (86.04%) and 117 men (13.96%), aged 1–80 years. The average age of all patients was 38.38±17.00 years, varying slightly between genders (38.18±16.42 Vs 39.59±20.27) years for females and males respectively (table 1). Furthermore, 57.86% of subjects were vitamin D deficient at a cut-off 20 ng/ml (table 1).

Association between gender and 25(OH) D levels

The average level of 25(OH) D was 19.89±10.28 ng/ml in the population studied; however, it was slightly higher in males (24.58±8.840 ng/ml) than in females (19.13±10.30 ng/ml). A significant association is established between gender and vitamin D deficiency ($X^2 = 32.33$; P value<0.0001) (figure 1). Females have a significant 3 times higher risk being vitamin D deficient than males (Odds ratio 3.18; CI 1.851 to 5.483). Conversely, the optimal levels were higher in males (22.03 % VS. 12.6%) however the insufficiency in females was less than those in males (25.62% and 44.07%).

Association between age and vitamin D status.

The highest number of deficient patients was of age group [30-40] years with a prevalence of 69.54 % (However, a higher prevalence in age group [10-20] was evident where 74.39% of

patients in this age range were deficient. A Significant association between age and vitamin D status was observed in females (X^2 =55.21; P value<0.0001) (figure 2). The prevalence of deficiency in females of same these groups was the highest in age group [30-40]. However, No significant association between age and vitamin D status in males (X^2 =8.687; P value=0.7294) (figure 2).

Table 1: Descriptive statistical data of subjects

	Subjects		AGE (years) Mean ±SD	Vitamin D 25(OH) D levels		
	N°	%		Deficiency	Insufficient	Optimal
Females	721	86.04%	38.18±16.42	61.77%	25.63%	12.6%
Males	117	13.96%	39.59±20.27	33.90%	44.07%	22.03%
Total	838	100%	38.38±17.00	57.86%	28.21%	13.93%

A weak positive significant correlation between age and vitamin D concentration was observed (*r*=0.1282; P-value=0.0002) reflected mainly in female subjects (*r*=0.1599; P-value<0.0001) while no significant correlation was observed in males (*r*=-0.07228; P-value=0.4386) (figure 3).

Association between serum calcium level and vitamin D concentration

A weak positive significant correlation between calcium level and vitamin D concentration (*r*=0.1216; P-value<0.0004) was observed in studied subjects. This significance was profound in females (*r*=0.1041; P-value<0.0051) however was non-existent in male subjects (*r*=0.03511; P-value<0.7071) (figure 4).

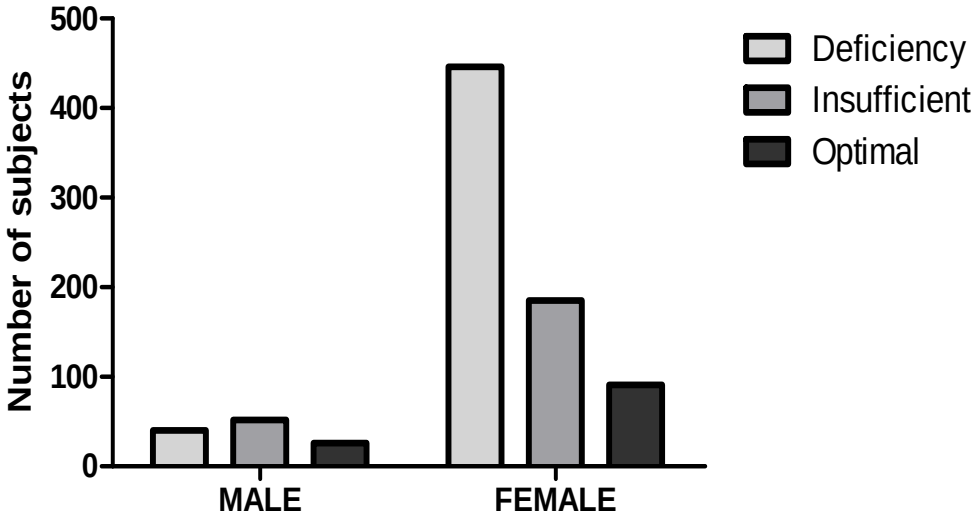

Figure 1. Distribution of individuals tested according to vitamin D status and gender. (X^2 = 32.33; P value<0.0001).

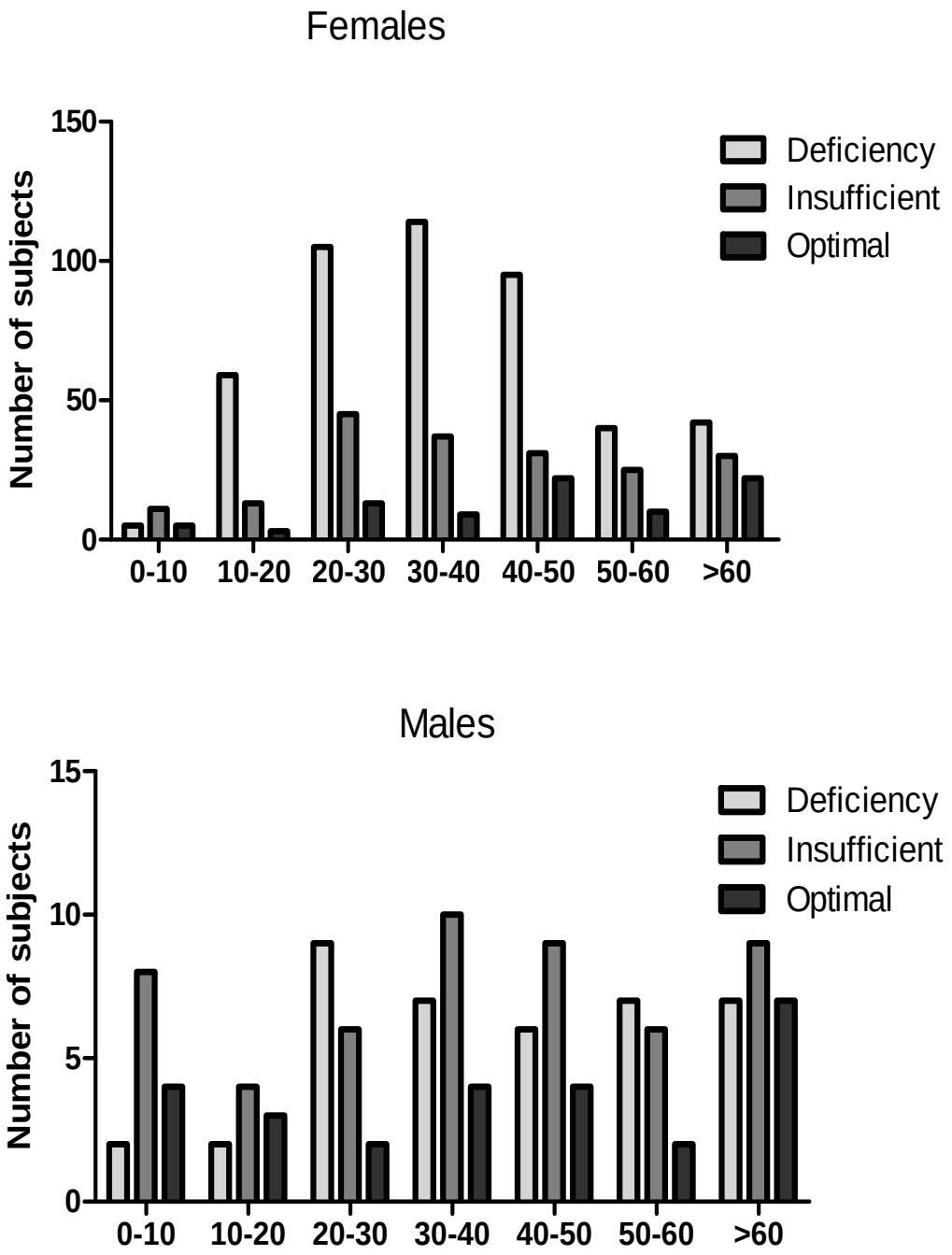

Figure 2. Distribution of individuals tested according to vitamin D status and age.

Females (X^2 =55.21; P value<0.0001); Males (X^2 =8.687; P value=0.7294).

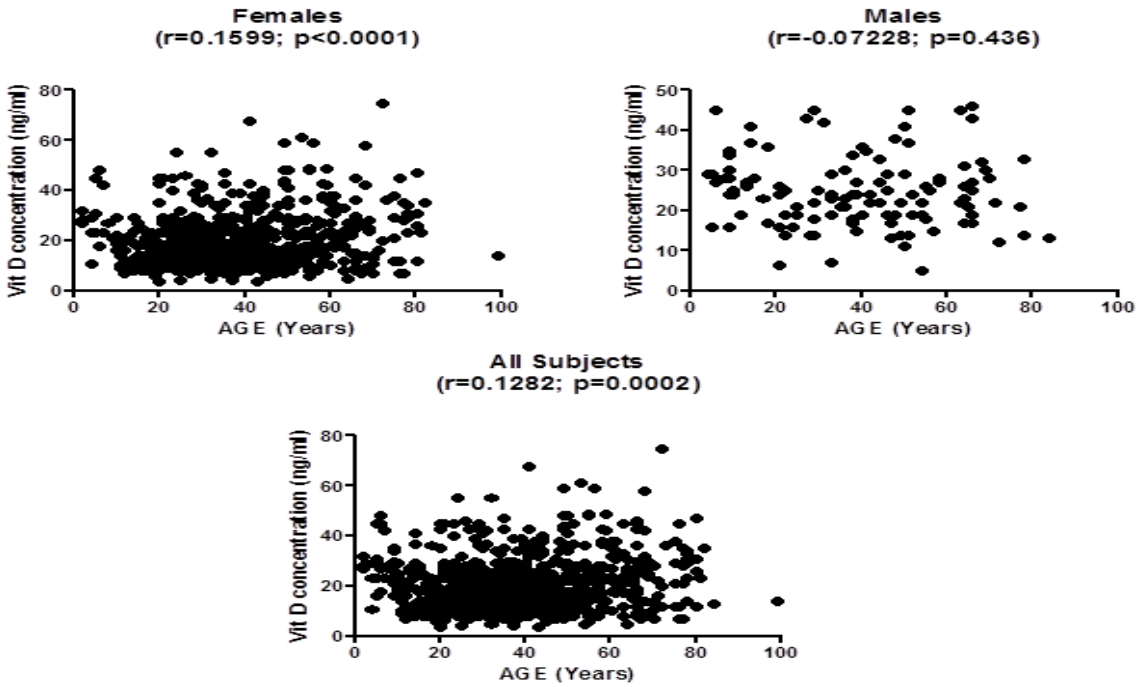

Figure 3. Correlation between vitamin D concentration and age.

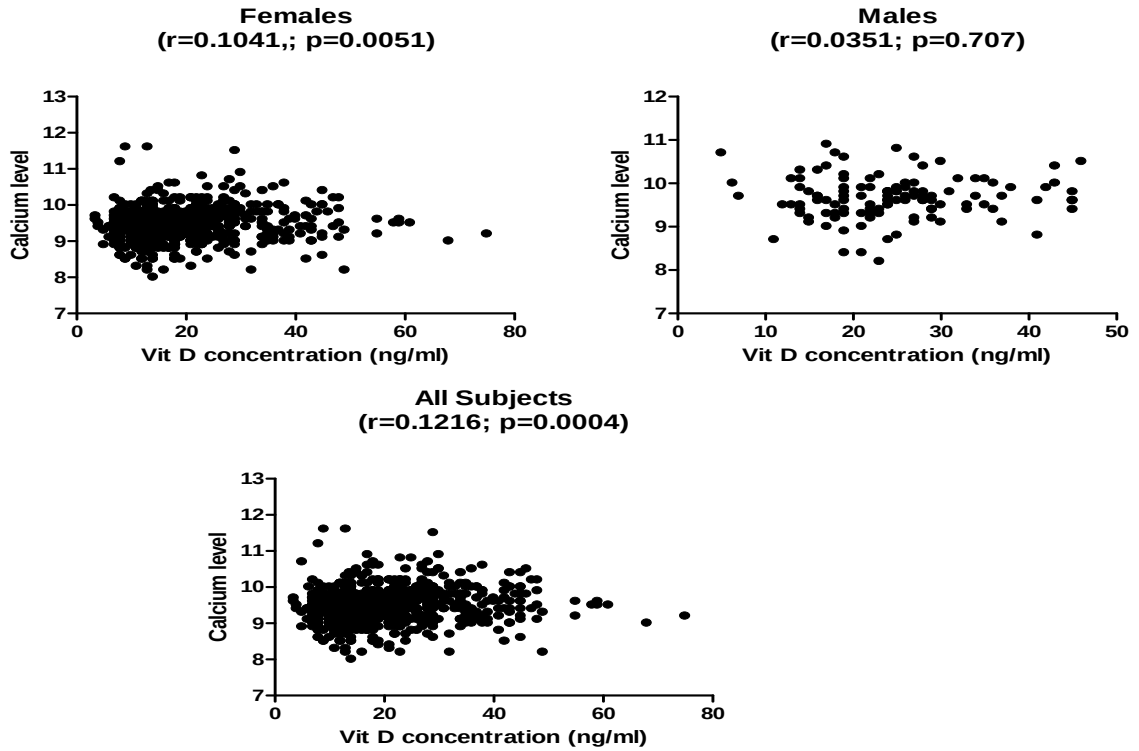

Figure 4. Correlation between vitamin D concentrations and serum calcium levels.

DISCUSSION

Vitamin D deficiency has shown to be of substantial prevalence in most countries of the Middle East and North Africa (El-Rassi R, 2009) in variable and alarming rates ranging

between 30% and 90% (Bassil D, 2013). In our study, it was shown that vitamin D deficiency was highly prevalent in subjects from the area of greater Beirut where 57.86% of subjects were vitamin D deficient at a cut-off 20 ng/ml with a mean of 19.89±10.28 ng/ml. Tthese results were highly similar to those in previous studies on Lebanese elderly and adult populations that had also a mean of 10-30 nm/ml (El-Rassi R, 2009). furthermore, our study has also included the aspects of vitamin D status in children of age group 10-20 years which has shown the upmost prevalence (74.39%) among all age groups. This also correlates with another study providing an overall 52% insufficiency in the studied children of age ranging between 10-16 years (Hajj Shahine C, 2001), provided that the percentile difference may be due to subjects of ages 16-20 years who were comprised in our study.

In our study, we have found that females are at 3 times more risk to be vitamin D deficient. This significant difference in the prevalence between females and males was observed in many epidemiologic studies across Europe, where a study conducted in seven European countries (Ireland, Netherlands, Spain, Greece, UK, Poland and Germany) 36.6% females vs. 22.6% males were deficient (Manios Y, 2017). Similar result of higher prevalence of vitamin D deficiency was also prevalent in south Asian countries like south India, Pakistan and South Asian immigrants in the UK, Denmark and Norway (Masood SH, 2008). Needless to say, women in Arab countries (e.g. KSA, Qatar, UAE, Kuwait, Oman and Jordan) have also shown lower 25(OH)D levels than males (Abdulrahman Al-Mohaimeed, 2012) Lebanese-base studies, the differences in vitamin D levels related to gender and prevalence in females was also observed (Bassil D, 2013) in adults (Gannage-yared MH, 2000) and pediatrics (Hajj Shahine C, 2001). However, it is noticeable to say that a one of a kind Lebanese study considering parameters like age, sex, seasonal changes and PTH levels (Bassil D, 2013), has presented results where males were at higher risk of being below the standard vitamin D cutoff of 20ng/ml this can very well be attributed to the difference between male and female physiology and most importantly the gestational paradigm of women.

It has been suggested that an independent predictor for low vitamin D levels is multi-parity along with the lack of antenatal care (A Mithal, 2009). A Saudi Arabian study on pregnant women has shown that almost 58% of subjects had levels below optimal which reflected an 88% of deficiency in neonates (Fouda MA, 2017). In addition; it is highly possible that the conservative life style and clothing of the majority of Arab women are another divergent between men and women. A study on Lebanese adult population has shown that veiled

woman had almost a 3 times higher prevalence of severe hypovitaminosis D (Gannage-yared MH, 2000) than non-veiled women subjects.

It has been well established that vitamin D deficiency spares no age group. In our study, this deduction has been proven in all age groups where prevalence ranged between 44-74% in ages 10 - >60 and over 20% in children. The highest number of deficient patients was in the range of 20-30 years of age, though a higher prevalence was indicated in younger adolescents, 10-20 years of age. These results correlate with results provided in studies across MENA. In Lebanon, several studies have been associated with vitamin D deficiency in different age groups. This deficiency prevailed in several; Paediatrics (Hajj Shahine C, 2001) adults (Gannage-yared MH, 2000) and elderly in the study of Arabi 2006 et al (El-Rassi R, 2009). In Iran, younger age was a predicament for low vitamin d levels as shown in a study of kaykhael et al (Bassil D, 2013) in another Iranian study the prevalence of vitamin D deficiency was compared different age groups and was higher among the younger age-group (Hovsepian, 2011). In Palestine, older age was a predictor of the low vitamin D levels as was shown in north African countries like Morocco and Tunisia (Bassil D, 2013). A great prevalence was found in Saudi Arabian study on preschool children and infants (Bahijri 2001). Similar results of all age groups results were found in Kuwait, Jordan and UAE (El-Rassi R, 2009).

All age groups may face deficiency for different reasons as in dietary intake in the case of children (Bahijri 2001) (Hajj Shahine C, 2001) and pregnant women (Fouda MA, 2017) or due to traditional wear (El-Hajj Fuleihan, 2009) and ethnicity where Muslim woman was shown to be at higher risk than Christian women that being related to simple veiling (Gannagé-Yared MH, 2009). These facts require extreme awareness and regarding to vitamin d deficiency as a multi generation crisis needing all possible attention.

In relation to calcium serum levels, our study has concluded a weak positive significant correlation between calcium level and vitamin D concentration, more profoundly in females. Although calcium serum levels were not significantly low, this cannot tell that vitamin D status is optimal or sufficient, for the body's requirements of calcium can be due to PTH's action (Deluca, 2004). In another study of Lebanese subject, a similar positive weak correlation was observed, in which 2.6% had hypocalcemia (Gannage-yared MH, 2000).In a study of Saudi Arabian children 95.3% out of which is either vitamin D deficient or insufficient, only 1.6% had significant hypocalcemia (Adnan M. Al Shaikh, 2016). These low

levels can also be attributed to the low intake of calcium and calcium fortified products. A Lebanese based study on children has shown that only 12% of the subject met the adequate calcium intake recommendation of 1300 mg/day (Salamoun MM, 2005). Two other studies have also shown a prevalence of low calcium intake, more significant in females both for children (Hajj Shahine C, 2001) and adults (Gannage-yared MH, 2000). In our study, no correlation between calcium levels and vitamin D deficiency in males. Having already stated the higher daily intake of males and the correlation with deficiency itself with vitamin D deficiency this result can be somehow expected. Furthermore, the absence of this correlation is being also found in a study on Middle Eastern male sportsmen (Hamilton B, 2010). However, no generalization can be deduced since this result can be different among different age groups, living areas, and socioeconomic statuses.

CONCLUSION

In summary, considering these Lebanese subjects tested as representative sample gives a clear idea to the prevalence of vitamin D deficiency in Lebanese populations. It's 3 times more prevalent in women of middle-aged groups. Eyeing the great similarity of cultural behaviours, clothing styles, diet and general lifestyle, suggests quite an extrapolation towards other neighbouring countries of the Middle East and North Africa. Further studies and wide-scale cooperation statistical data, are a must. This is because previous ones, though are many, yet have been mostly conducted on small, non-population-based studies, which are stand alone and seem to have failed to include all possible risk factors of different age groups with circadian and seasonal changes within the same study or country.

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