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Evaluation of serum Vitamin D levels according to gender and age in the population of Amman City, Jordan

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Background: Vitamin D is considered an essential nutrient with many bio-vital functions in the human body. Its deficiency is associated with many chronic diseases. Methods: Cross-sectional retrospective study was performed to determine the prevalence of vitamin D 25-hydroxy vitamin D (25-OHD) levels among 4131 apparently healthy Jordanian people. Results: The study results on Vitamin D levels showed that the prevalence of the 0–2-year group was 1%. The mean ± SD of vitamin D in the 0-2 years group was 47.5 ± 24.5, which is considered to be within the normal range, while the spread of the 3-17 age group was 7.5% of the mean ± SD of vitamin D in the 3-17 years group was 19.2 ± 24.7 which considered being a moderate deficiency, on the other hand, the percentage of >18 group was 91.5 % the mean ± SD of vitamin D in this group was 22.9 ± 14.0 which is considered to be a mild deficiency. Conclusion: it appears that there is a high prevalence of vitamin d deficiency, and more efforts should be made to encourage the population to be awarded beneficial nutrition and tappets, also more studies are recommended to reevaluate the normal ranges and genetic deposition in Jordan.

Keywords: Serum Vitamin D, micronutrient, Jordan

INTRODUCTION

Vitamin D is an essential fat-soluble vitamin that is important for calcium maintenance homeostasis for bone health, and it has been related to hypertension, diabetes, metabolic syndrome, cancer, and autoimmune diseases (Palacios and Gonzalez 2014).

Vitamin D deficiency is also associated with many chronic diseases as depression, neurocognitive function, and increased occurrence of infection (Feldman et al. 2014; El-Khateeb et al. 2019). In humans, many organs are involved in the synthesis of vitamin D as the kidneys, skin, and liver.

Vitamin D (calciferol) is not a true vitamin since humans can synthesize it with adequate sunlight exposure. Vitamin D may also be ingested in the diet in the form of vitamin D3, a prohormone. Food sources include fortified milk, saltwater fish, and fish liver oil (Al-Qudah et al. 2021; El-Qudah et al. 2008).

Vitamin D deficiency is highly prevalent worldwide in all age groups (Palacios and Gonzalez, 2014; Karin Amrein et al. 2020), and it is noted when the level of serum 25(OH)D fails below 10 ng/mL (25 nmol/L) (Farhatullah et al. 2019). The serum concentration of vitamin D reflects endogenous synthesis from exposure to sunlight and exogenous intake in diet (Haroon K et al. 2013; Khasawneh et al. 2018).

Recent studies on adults suggested that 25(OH)D alone may be a poor biomarker of bone health, not associated with bone mineral density or risk of fractures (Ginsberg et al. 2018). Also, the concentration of a total of 25(OH)D<20 ng/mL (<50 nmol/L) was accepted as an insufficiency, according to the recommendations for pediatric populations (Esposito et al. 2019).

Recently, the term 25 vitamin D deficiency was used to describe low serum 25(OH)D status (Thacher TD, Clarke 2011). Levels above 30 ng/mL (75 nmol/L), between 10 and 30 ng/mL (50–75 nmol/L), and below 10 ng/mL (50 nmol/L) are sufficient, inadequate, and deficient, respectively (Holick 2005).

Although the human body can synthesize vitamin D, some people are more likely to be at risk of a deficiency than others. Factors that can influence this include Skin color, Lack of sun exposure, older adults with conditions that limit fat absorption, and people with obesity since high levels of body fat can limit the body's ability to absorb vitamin D from the skin.

A worldwide public health intervention that includes vitamin D supplementation in certain risk groups and systematic vitamin D food fortification to avoid severe

vitamin D deficiency would appear to be important (Karin Amrein et al. 2020).

Low vitamin D concentration in blood is an important health problem in many countries, whereby the deficiency is common in countries, including Norway, Italy, Japan, India, and the Middle East (Zahra et al. 2014). Subclinical vitamin D deficiency is still widely prevalent in both developed and developing countries with a worldwide prevalence of up to 1 billion (Nair and Maseeh, 2012).

Vitamin D sufficiency or deficiency is evaluated by the measurement of serum 25-hydroxyvitamin D. Optimal serum levels of 25-hydroxyvitamin D are still a matter of controversy. There are substantial differences in mineral metabolism amongst different races (Dawson-Hughes et al. 2010).

This study aimed to investigate serum 25(OH)D levels in a sample of the Jordanian population according to age and gender in Amman, Jordan.

MATERIALS AND METHODS

Since this cross-sectional retrospective study was designed to determine the prevalence of vitamin D deficiency among the population of the capital city of Jordan, Amman, in this cross-sectional study, the study had 4131 healthy people attend reference Medical Laboratories from January 2021 to December 2021 to have Vitamin D test. After the acceptance by the ethical committee of medical allied sciences at Zarqa University, written informed consent was obtained from all patients.

Blood Sampling and Preparation

Five ml of peripheral venous blood was collected by vein puncture from all subjects under the study five ml was collected into uncoated vacationers (lab system, Egypt) and left for 30-60 minutes at 37ºC to clot, followed by 1 hour at 4ºC to retract the blood clot. Finally, blood samples were centrifuged at 1000 rpm for 10 minutes at room temperature. Samples were collected and stored in aliquots at -80ºC until used.

All serum samples were tested for 25-hydroxy vitamin D (25-OHD) using Elecsys Vitamin D total II kits (Roche Diagnostics, Mannheim, Germany). The normal range for vitamin D (25- OHD) was 30-40 ng/ml. The value <10ng/mL was noted as a severe deficiency, 10-20ng/ml was noted as a moderate deficiency, and 21-29.9ng/ml was noted as a mild deficiency or insufficiency (Agarwal et al. 2013).

All static analyses were performed using the IBM SPSS software package version 20.0. (Kotz et al. 2006; Kirkpatrick et al. 2013). Qualitative data were described using numbers and percentages. Quantitative data were described using range, mean, standard deviation, and median. The significance of the obtained results was judged at the 5% level. The hypothesis testing method included a Chi-square test for categorical variables to compare different groups. Student t-test, for ordinarily quantitative variables, to compare two studied groups. And the Mann-Whitney test for abnormally quantitative variables to compare two studied groups.

RESULTS

Four thousand one hundred thirty-one participants were enrolled in this study. The results showed that vitamin D levels ranged in participants from 2.9 to 96.6 ng/ml with mean±SD (22.6±14.1). The detailed gender, age, and vitamin d level of the participants are presented in **table 1**. Most of the participants were females (2931 (70.8%) versus 1200 (29.2%) males). A significant elevation in vitamin D levels (P<0.001) was observed in the 0-2 years age group.

The prevalence of the 0-2 years group was 1%, and the mean ± SD of vitamin D in the 0-2 years group was 47.5 ± 24.5 ng/ml, which is considered to be within the normal range, while the spread of the 3-17 year age group was 7.5% of the mean ± SD of vitamin D in the 3-17 years group was 19.2 ± 24.7 ng/ml which considered being a moderate deficiency, on the other hand, the percentage of >18 years group was 91.5 %, the mean ± SD of vitamin D in this group was 22.9 ± 14.0 ng/ml which is considered to be a mild deficiency (Table 1).

Table 1: Vitamin D levels distribution

Age Group	Female (n= 2931)			Male (n=1200)			Total (n= 4131)			P value
	#	%	Means ± S.D	#	%	Means ±S.D	#	%	Means ± S.D	p<0.001
0-2 years	15	0.5	50.6±24.9	18	1.5	44.9±24.2	33	1%	47.5 ± 24.5	
3-17 years	203	7	18.0 ± 9.3	105	8.7	21.7±11.3	308	7.5%	19.2±24.7	p<0.001
≥ 18 years	2713	92.5	22.8±14.3	1077	89.8	23.1±13.5	3790	91.5%	22.9±14.	p<0.001

The results in figure 3 results showed a strong positive correlation between vitamin D levels and age among females, r=0.331, p<0.001, and a strong positive correlation between vitamin d levels and age among males r=0.167, p<0.001 **(** Table 2).

Table 2: Correlations of **Vitamin D levels and ages**

	Sex			Vitamin D	Age
Spearman's rho	F	Vitamin D	Correlation Coefficient	1.000	.331**
			Sig. (2-tailed)	.	.000
			N	2933	2933
		Age	Correlation Coefficient	.331**	1.000
			Sig. (2-tailed)	.000	.
			N	29331	2931
	M	Vitamin D	Correlation Coefficient	1.000	.167**
			Sig. (2-tailed)	.	.000
			N	1203	1203
		Age	Correlation Coefficient	.167**	1.000
			Sig. (2-tailed)	.000	.
			N	1200	1200
**. Correlation is significant at the 0.01 level (2-tailed).					

Figure (1) showed a statistically significant difference in median vitamin D levels among age groups less than two years. 37.5 (8.4, 93.7), 3-17 years 15.4 (3.6, 68.5), and adults 19.7 (2.9,96.9) W=61.2, df=2, p<0.001.

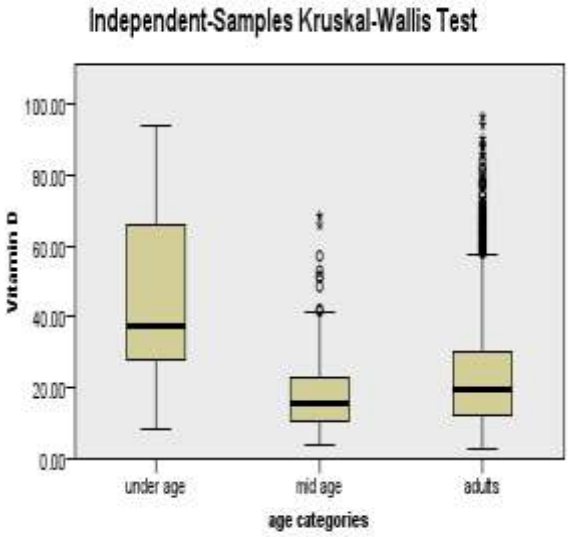

Figure 1: Significant difference in median of vitamin D levels among participants

Key: Under age: 0-2 years category (less than 2 years), mid age: 3-17 years category (3-17) year, adults: ≥ 18 years category (more than 18 years)

Figure 2 showed a statistically significant difference in median vitamin d levels between females less than two years 41.4 (24.9, 92.9), female 3-17 years age group 13.6 (3.6, 57.2), and female adults 19.7 (2.9, 94.2) W=56.3, df=2, p<0.001.

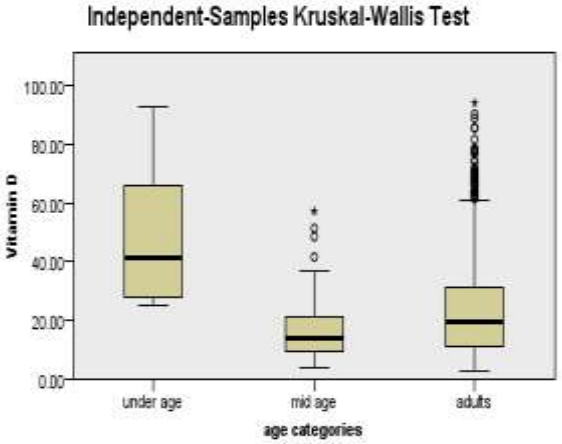

Figure 2: Significant difference in median vitamin D levels among females.

Key: Under age: 0-2 years category (less than 2 years), mid age:3-17 years category (3-17) year, adults: ≥ 18 years category (more than 18 years)

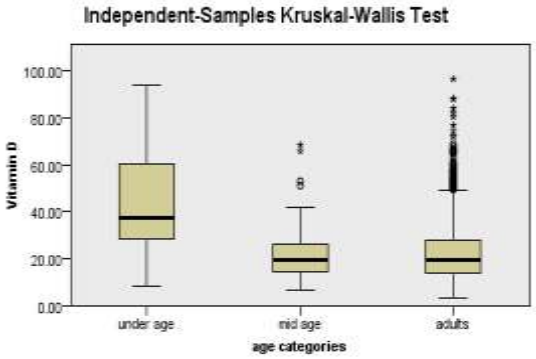

Figure 3: Significant difference in median vitamin D levels among males.

Key: Under age:0-2 years category (less than 2 years), mid age:3-17 years category (3-17) year, adults: ≥ 18 years category (more than 18 years)

Figure 3 showed a statistically significant difference in median vitamin D levels between males less than two years age group 37.3 (8.4, 93.7), male 3-17 years group 19.4 (6.3, 68.5), and male adults 19.6 (3.4, 96.6).

DISCUSSION

Vitamin D contributes to the human body in many ways, such as enhancing calcium absorption in the gut and maintaining sufficient calcium serum and phosphate concentrations to promote normal bone mineralization and prevent hypocalcemic tetany reduction of inflammation as well as modulation of such processes as neuromuscular, immune function, and cell growth and glucose metabolism (Zhu Z. et al. 2012; Jones G 2014; Palacios and Gonzalez 2014).

The primary goal of this study was to determine the prevalence of vitamin D insufficiency among adults residing in Amman.

This study demonstrated that the mean level of 25(OH)D among young children -less than two years - was much higher than that of any other stage. In correspondence with this study, the results of (Feng Wei et al. 2018) pointed out that the highest mean level of serum of 25(OH)D was found at the 1–3 years stage. The parents of young children provided breast milk and different kinds of vitamin D supplements as oil drops which can be easily found in pharmacies in Amman for children. On the other hand, (Khuri-Bulos et al. 2014) found the prevalence of severely low vitamin D levels in newborn infants in Amman, Jordan.

In a study conducted in Iraq, the mean Vitamin D serum level in adult males and females was found to be 20.63±3.48 ng/ml and 18.59±2.86 ng/ml, respectively (average aged 30. 0±6.43 and 30. 46±7.97 respectively), and the vitamin D insufficiency was (20-30 ng/mL).

A study conducted in Libya found that Vitamin D status assessment revealed inadequate levels (25(OH)D< 50 nmol/l) in almost 80% of participants. Women (25-64 y) were identified as the most vulnerable group with vitamin D inadequacy present in 82% (61.6% had 25(OH) D < 25 nmol/l, and 20.2% had 25–50 nmol/l 25(OH)D) (Fathia Faid et al. 2018).

Studies carried out in Saudi Arabia showed a high prevalence in pediatrics and other groups. A study conducted on 247 female students, mean age 22-29 years, in the Northern Border area of Saudi Arabia found that the mean 25-hydroxycholecalciferol level was 7.59 (SD 1.9) ng/ml. Moreover, all the participants (100%) were found to have vitamin D deficiency, defined as 25(OH)D ≤ 20 ng/ml. Severe vitamin D deficiency was found in 220 (89.1%) (Sulaiman AH et al. 2017).

Vitamin D Deficiency is associated with many diseases like cardiovascular disease. There is a clear contrast among populations, races, and geographic areas in vitamin D deficiency effects and symptoms due to the differences in factors such as age, sex, area of living, nutrition, and nutritional habits.

Studies showed a clear link between immunity response and infectious disease and Vitamin D Deficiency.

The wide spread of Vitamin D Deficiency urges the health care management to monitor this public health problem which is challenged by the heterogeneity of nutritional and clinical dealing and update the vitamin D guidelines, diagnostic tools, and tests, to encourage people to do frequent chick and treatment. Nowadays, more efforts should be done to update the roles, tests, normal values, diagnosis, and treatments of vitamin D deficiency and overdoses.

CONCLUSION

It appears that there is a high prevalence of vitamin D deficiency, and more efforts should be made to encourage the population to be awarded beneficial nutrition and tappets, also more studies are recommended to reevaluate the normal ranges and genetic deposition in Jordan.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

ASD, OMA, and JME designed and performed the experiments and also wrote the manuscript. HAA, AEH, OMA, and KA reviewed the manuscript. All authors read and approved the final version.

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