

Arthralgia an indicator of Vitamin D3 Deficiency and Insufficiency

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ABSTRACT

Objective: To determine the prevalence of Vitamin-D deficiency and insufficiency in patients complaining of arthralgia.

Patients and Methods: This cross-sectional study included a group of 332 individuals complaining of arthralgia, selected by consecutive sampling technique. Vitamin-D blood level was performed by ELISA method. Data were entered and analyzed using SPSS Software (Version 15). Mean and Standard deviation was calculated for Quantitative variables and frequency with percentage was presented for Qualitative variables. Chi-Square test was applied to assess any association between Qualitative variables. P value less than 0.05 was considered significant.

Results: Out of 332 individuals who had arthralgia, 9.03% (30), 12% (17) and 85.84% (285) had Vitamin-D sufficiency, insufficiency and deficiency. Among total sample population, 75.0% (249) were females and 25.0% (83) were males. In females 8.83% (22), 6.02% (15) and 85.1% (212) had Vitamin-D sufficiency, insufficiency and deficiency (p-value 0.430). Out of 212 Vitamin-D deficient females, 48.5% (103), 16.98% (36) and 34.4% (73) had severe, moderate and mild Vitamin-D deficiency (p-value=0.844). In male patients 9.63% (8), 2.40% (2) and 87.95% (73) of males had Vitamin-D sufficiency, insufficiency and deficiency (p-value=0.430). Out of 73 Vitamin-D deficient males, 45.20% (33), 16.43% (12) and 38.3% (28) had severe moderate and mild Vitamin-D deficiency (p-value=0.844). In females Vitamin-D deficiency was found to be most prevalent in age groups of 41-60 years. Whereas in males Vitamin-D deficiency was found to be most prevalent in age groups of 31-40 years.

Conclusion: Vitamin D deficiency/insufficiency is an important factor leading to arthralgia, keeping the prevalence rate of about 90% in mind.

Key words: Arthralgia, Deficiency, ELISA, Prevalence, Vitamin-D.

Author's Contribution

¹ Conception, synthesis, planning of research and manuscript writing Interpretation and discussion

² Data analysis, interpretation and manuscript writing, Active participation in data collection

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Article info.

Received: June 7, 2017

Accepted: August 20, 2017

Cite this article. Islam N, Farooq R. Arthralgia an indicator of Vitamin D3 Deficiency and Insufficiency. JIMDC.2017;6(4):

Funding Source: Nil

Conflict of Interest: Nil

Introduction

Vitamin D commonly called the "Sunshine Vitamin" is synthesized in the body when the skin is exposed to sunlight directly, making it unique amongst others. It is a fat-soluble vitamin and is commonly stored in the body's fatty tissue.¹ Vitamin D3, is essential for maintaining mineral homeostasis and normal skeletal architecture. Vitamin D and its synthetic analogues also have antiproliferative, prodifferentiative, and immunomodulatory

activities. Vitamin D3 has physiological and pharmacological actions in various systems, after the recognition of Vitamin D receptors (VDR) in target cells. There are potential therapeutic applications of VDR ligands in inflammation like dermatological indications, osteoporosis, cancers, secondary hyperparathyroidism, and autoimmune diseases.²⁻¹¹ Vitamin D3 circulating levels greater than 75 nmol/L, or 30 ng/mL, is beneficially

required for good health, at least 800–1000 IU vitamin D3 may be required for maintaining good health. Vitamin D2 when given in physiological concentrations may be equally effective for maintaining circulating concentrations of 25-hydroxyvitamin.¹²⁻¹⁷ Exposure to sunlight is the major source of vitamin D for most humans. Vitamin D is naturally present in oily fish like salmon and mackerel and oils from fish, including cod liver oil. Dairy products like cheese, butter, cream also contain Vitamin D. In developed countries fortification of milk products, juice products, breads, yogurts, and cheeses is done with vitamin D.^{18, 19} Vitamin D deficiency is recognized as a pandemic. It causes rickets in children and osteopenia, osteomalacia, osteoporosis, and fractures in adults.³⁰ Research has linked Vitamin D deficiency with increased risk of common cancers, autoimmune diseases, hypertension, and infectious diseases.¹⁹⁻²⁷ Inadequate nutritional intake of vitamin D along with inadequate sunlight, faulty vitamin D absorption, and failure of converting vitamin D into active form results in Vitamin D3 deficiency.²⁸⁻³² Serum Vitamin D3 concentration is the most reliable marker of vitamin D status.¹² Vitamin D deficiency is increasing day by day worldwide affecting individuals of all age groups. Global awareness about vitamin D benefits and its deficiency is still seriously lacking. People with Vitamin D deficiency may develop a feeling of being sleepy, lethargic, lazy, and tired along with body aches and muscle cramps. In addition to these signs the development and growth of body in infants and children may be affected, with delay in tooth formation and breathing difficulty.²⁸⁻³²

Patients and Methods

This cross-sectional study was conducted at Social Security Hospital Islamabad from 20-April-2011 to 20-April 2012. Sample size was calculated by using WHO Sample size calculator taking confidence level of 95%, anticipated population proportion 70% and absolute precision 5%.¹¹ Sample size turned out to be 323. Initially 350 individuals were included to overcome the possibility of dropouts. Patients complaining of arthralgia with age range of 2-86 years were selected by consecutive non probability sampling. Voluntary informed written consent was taken by all the study subjects. Those individuals refused to give informed consent were excluded. The

serum vitamin D3 levels were performed by ELISA. According to reference ranges, “Vitamin D3 concentrations >30 ng/mL are considered to be sufficient. Vitamin D3 concentrations of 51–74 nmol/L, or 21–29 ng/mL, indicate insufficiency. Whereas Vitamin D3 concentration <50 nmol/L, or 20 ng/mL, is an indication of vitamin D deficiency”. Vitamin D3 deficiency is further classified into severe, moderate and mild deficiencies. According to definition “Vitamin D3 levels below 5ng/ml is considered as severe Vitamin D3 deficiency, Vitamin D3 levels between 5-12ng/ml is considered moderate Vitamin D3 deficiency, whereas Vitamin D3 levels between 12-20ng/ml is considered mild Vitamin D3 deficiency”.¹² Data was entered and analyzed using SPSS Software (Version 15). Mean and Standard deviation was calculated for quantitative variables and frequency with percentage was presented for qualitative variables. Chi-Square test or Fischer exact tests was applied, to assess any association between qualitative variables. p-value less than 0.05 was considered statistically significant.

Results

Out of 332 participants, 83 were male and 249 were female. Male female ratio was 1:3. Among all patients suffering from arthralgia, 85.84% had Vitamin D3 deficiency, 5.12% individuals had an insufficient levels and only 9.03% individuals had a sufficient Vitamin D3 levels (Figure 1).

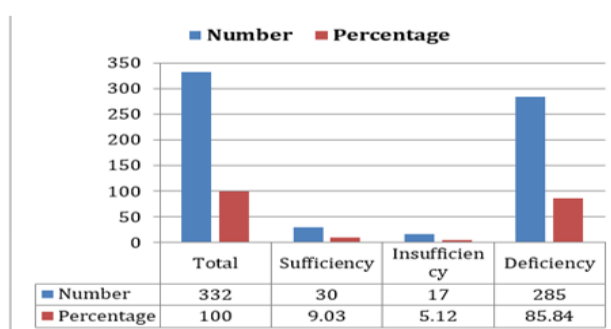


Figure 1: Vitamin D levels among study participants (n=332)

Gender wise distribution shows that (73) 87.95% of male and (212) 85.1% of female patients had Vitamin D3 deficiency. Among them, 45.20% males and 48.5% females had severe Vitamin D3 deficiency. Sufficient levels of vitamin D were found only in 9.63% males and 8.83% females (Table 1).

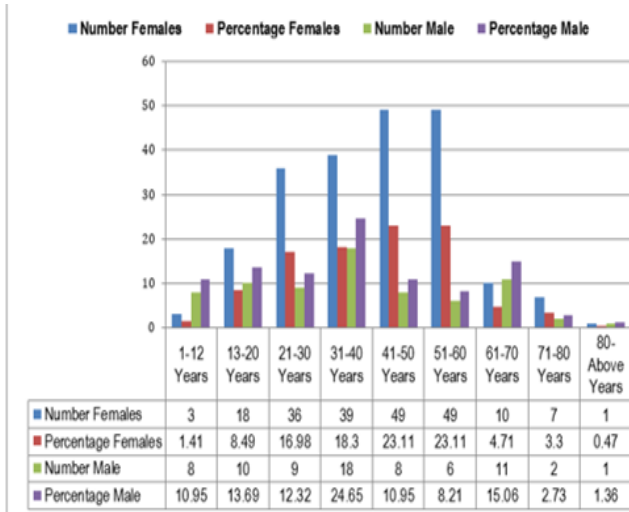


Figure 2: Vitamin D Deficiency in various Age Groups in Females and Male Patients.

Figure 2 showed significant association ($p=0.000$) of vitamin D deficiency levels in different age groups among females as compared to males. Among females Vitamin-D deficiency was found to be most prevalent in age groups of 41-60 years. Whereas in males Vitamin-D deficiency was found to be most prevalent in age groups of 31-40 years.

Discussion

Vitamin D deficiency is one the most common medical condition worldwide. According to an estimation, about one billion people in the world have vitamin D deficiency or insufficiency.¹⁹ Vitamin D deficiency has a high prevalence in Asian countries.³⁶⁻³⁹ A majority (90%) of Islamabad and Rawalpindi patients in this study were vitamin D deficient or insufficient. It is a matter of concern to see so much of Vitamin D deficiency in a country with ample sunshine. Increased pigmentation due to which more prolonged exposure to sun is required, inadequate dietary intake of Vitamin D, use of sun block, and Veil (purdah) observation, failure of conversion of Vitamin D into its active form in kidney, mal-absorption diseases and obesity may be responsible for Vitamin D deficiency.³⁸ Women are more likely to have vitamin D-deficiency than men.⁴⁰ The use of veil in most women or clothing habits like wearing scarf and full sleeves clothes as a religious or cultural tradition limits sunlight exposure which may be a main reason for increased prevalence of vitamin D3 deficiency in females as compared to males.³⁷ People also use anti-solar (sun blocks) creams on the exposed

area to prevent tanning. Apartments living is increasing day by day due to increase in population of the country and tendency to live in big cities are among other factors which restrict exposure to sun.

Table:1 Vitamin D Levels

	Gender of Patients		Total	P-Value	
	Male	Female			
Vit D Deficiency	73(87.95%)	212(85.1%)	285(85.84%)	0.430	
Vit D Insufficiency	2(2.40%)	15(6.02%)	17(5.12%)		
Vit D Sufficiency	8(9.63%)	22(8.83%)	30(9.03%)		
Total	83(25%)	249(75%)	332(100%)		
Severe Deficiency	33(45.20%)	103(48.5%)	136(47.7%)		0.844
Mild Deficiency	28(38.3%)	73(34.4%)	101(35.43%)		
Moderate Deficiency	12(16.43%)	36(16.98%)	48(16.84%)		
Total	73(25.61%)	212(74.38%)	285(100%)		

In females, Vitamin D3 deficiency is most prevalent in age groups of 41-60 years, which depicts that Vitamin D3 deficiency in females is common in middle and old age group. The reason for Increased Vitamin D deficiency in middle age group may be that usually requirement exceeds the intake of Vitamin D in reproductive and lactation period in life of women. Whereas in females of old age or post-menopausal women there is a marked decrease in oestrogen levels which may be a factor leading to Vitamin D deficiency in them. In males, Vitamin D3 deficiency is most prevalent in age groups of 31-40 years; however, there is no strong evidence based on previous research, which proves the actual cause of Vitamin D deficiency in a certain age group in male and female.

Certain factors like clothing style, air pollution, skin pigmentation, insufficient vitamin D intake, lack of routine fortification of foods with vitamin D in Pakistan, could be the main factors responsible for such high rate of vitamin D deficiency in our population. The limitation of our study was that we did not include the type of diet, use of food containing vitamin D, duration of exposure to sunlight, and other possible risk factors for vitamin D deficiency. In order to prevent Vitamin D deficiency 10 to 15 minutes of

sunshine, three times a week (between 10am to 3pm), is recommended which will produce sufficient Vitamin D required for normal functioning of the body.³⁸ People who do not live in sunny places may not make enough vitamin D through sun light, must fulfil their body Vitamin D requirements by diet. Vitamin D is found in dairy products like cheese, butter, cream and fortified milk. Fatty fish (such as tuna, salmon, and mackerel), Fortified breakfast cereals, margarine, and soy milk are also a rich source of Vitamin D.^{38,39} In case of severe deficiency Vitamin D supplementation is required. Depending upon age, situation and severity of the deficiency the doctor will prescribe the correct dosage of Vitamin D, which will be given as a medicine in syrup or tablets form, or in injectable form during severe deficiency.³⁹⁻⁴¹

Conclusion

Vitamin D3 Deficiency and Insufficiency is Prevalent in above 90 % of Islamabad and Rawalpindi population presenting to physicians with arthralgia. So patients suffering from arthralgia or aches and pains should be checked for Vitamin D levels initially and may be given a symptomatic treatment for vitamin D3 deficiency.

Recommendations

Based on the findings of the study, we recommend fortification of food with vitamin D3 and adequate exposure to sunlight to prevent vitamin D deficiency and assessment of vitamin D status in routine, especially those with complaint of pains and aches.

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