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ORIGINAL ARTICLE

Evaluation of Hypovitaminosis D in different age and gender groups in Khyber Pakhtunkhwa Pakistan

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ABSTRACT

Background: Hypovitaminosis D is associated with many chronic disorders such as cancer, osteoporosis, cardiovascular, rickets, and musculoskeletal disorders. Therefore, this study was designed to determine the level of vitamin D in our region.

Methods: A total of one hundred and ninety-five adult participants were enrolled. Patients were referred by medical physicians and consultants after identifying the sign and symptoms of Hypovitaminosis D. Both male and female gender were recruited and patients with severe chronic disorders were excluded from the study. Vitamin D levels were categorized into four groups including deficiency of vitamin D (<10 IU), insufficient vitamin D level (10-30 IU), Normal vitamin D level (30-100 IU), and Hypervitaminosis level of vitamin D (>100 IU).

Results: The minimum and maximum age of the patient was 17 and 57 years age with the mean age of all patients being 33.833.8±17.3. Male and female patients were 79.5% (n=155) and 20.5% (n=40). The highest number of patients were identified in the age group 36-45 years. Vitamin D level was found in 7.7% deficient while insufficiency of vitamin D was found in 48.7%. Insufficiency of vitamin D was found more in female (67.5%) patients than in males (43.9%). The highest prevalence of vitamin D insufficiency was obtained in the age group 16-25 years. No patient was found with hypervitaminosis D.

Conclusion: There is a high deficiency of vitamin D in patients particularly in females and younger age populations. Awareness about vitamin D importance, psychosocial intervention, and vitamin D supplementation should be implemented to prevent any severe consequences of Hypovitaminosis D.

Keywords: Vitamin D, Hypovitaminosis D, Age, Gender

INTRODUCTION

Vitamin D is also called sunshine vitamin or also referred to as calciferol. Vitamin D insufficiency affects almost 50% of the population worldwide[1]. Hypovitaminosis D is a pandemic in which several factors contribute including environmental, and lifestyle[2]. Hypovitaminosis D is an important public health problem[3]. Vitamin D play essential role in cell proliferation, differentiation, and apoptosis[4]. Hypovitaminosis D may leads to rickets in children due to bone softening and de-mineralization[5,6]. While in adults particularly in women cause osteomalacia and osteoporosis, resulting of bone fractures[7, 8].

Vitamin D receptors are distributed throughout the body and they have a role in greater than 200 human genes[9], showing diverse functions in maintaining human health[10]. Vitamin D has the main role in immunity, reproductive, muscular, skeletal, and integumentary systems in all ages of people[11]. It is reported that vitamin D level is significantly associated with chronic diseases[12].

Several factors are involved in Hypovitaminosis D such as old age, race, use of medications having antagonist effects on the metabolism of vitamin D, high body mass index, inadequate use of vitamin D supplementation, lack of exercise, education, and awareness about vitamin D importance[13]. Presently, Hypovitaminosis D has been reported pandemic throughout the world[1, 14] and reported 30-93% deficiency in different studies[15, 16].

For the last two decades, it is reported that Hypovitaminosis D is also high in tropical countries including China[17], India[18], Iran[19], Saudi Arabia[20], and Turkey[21] where sunlight plays a significant role. Pakistan is considered one of the sun-drenched countries in the globe and its supposed to have enough sunlight to maintain an adequate level of vitamin D but Hypovitaminosis D is also prevalent in Pakistan[22]. Hypovitaminosis D is also reported in pregnant[23], lactating women, and infants in Pakistan[24, 25]. Few studies reported from our region therefore, this study was designed to determine the level of vitamin D in our population.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in a duration of three months from January to March 2022. The study was carried out in the department of Biotechnology at Abdul Wali Khan University, Mardan, along with the collaboration of Real-Time PCR Laboratory, Dabgeri Garden, Peshawar, Pakistan. One hundred and ninety-five patients were recruited for the present study. All those patients who had been referred by medical physicians and consultants based on the sign and symptoms of Hypovitaminosis D in patients were included irrespective of age, gender, and ethnicity of patients. Whereas those patients had other comorbidities including celiac disease, unexplained musculoskeletal pain, cystic fibrosis, bony deformities or tenderness, Crohn's disease, metabolic bone disease, patients had a history of any surgery on the intestine or stomach, malignancy, patients with a history of pituitary gland problem, pregnant and lactating females, kidney diseases, asthmatic patients and other known chronic disease patients were excluded from the study. Moreover, those patients who were not willing to take participation in the research study were excluded from the present study.

Ethical approval was taken from the Real-Time PCR Laboratory, Dabgeri Garden, Peshawar, and the Department of Biotechnology at Abdul Wali Khan University, Mardan. Informed consent was obtained from the patients before recruitment in the study.

Vitamin D levels were evaluated through the detection of 25-OH-D levels. Therefore, 5 ml peripheral blood was collected in a serum separator tube (SST provided by BD vacutanier®) from all the participants at the time of the laboratory visit after the medical physician and consultant checkup. The collected sample was centrifuged and the serum 25-OH-D level was determined through the Enzyme-linked immunoassay technique (ELISA). The participants were categorized into four groups according to 25-OH-D levels in their sera: 1) Deficiency: <10 IU; 2) Insufficient: 11-30 IU; 3) Normal: 31-100 IU; and 4) Hypervitaminosis D/Toxicity >100 IU.

Descriptive statistics were used for demographic, and laboratory test data, and proportions were observed in collected data. The data were analyzed through Statistical Package for Social Science (SPSS) version 22. Means and standard deviation were determined.

RESULTS

A total of one hundred and ninety-five participants (n=195) were included. The mean age of patients was 33.8±17.3 with a minimum

of 17 years of age and a maximum of 57 years of age. Among the total, 79.5% (n=155) were male patients with a mean age of 35.3±10.1. Whereas female patients were 20.5% (n=40) with a mean age of 28.7±9.91. All patients were categorized into five groups. The highest number of participants were determined in the age group 36-45 years (29.2%), followed by the age group 26-35 years (28.7%), 16-25 years age group (27.7%), 46-55 years age group (11.3%), and 55-65 years age group (3.1%) (Table 1).

Table 1: Distribution of study participants in different Age and Gender groups (n=195)

Age (Years)	Male % (n)	Female % (n)	Total % (n)
16-25	20.6 (32)	55.0 (22)	27.7 (54)
26-35	30.3 (47)	22.5 (09)	28.7 (56)
36-45	32.9 (51)	15.0 (06)	29.2 (57)
46-55	12.9 (20)	5.0 (02)	11.3 (22)
55-65	3.2 (05)	2.5 (01)	3.1 (06)
Grand Total	79.5 (155)	20.5 (40)	100 (195)

All patients' blood was analyzed for vitamin D levels. Vitamin D levels were categorized into four groups including deficiency of vitamin D (<10 IU), insufficient vitamin D level (10-30 IU), Normal vitamin D level (30-100 IU), and Hypervitaminosis level of vitamin D (>100 IU). Vitamin D level was deficient (7.7%), insufficient (48.7%), and normal (43.6%) in n=15, n=95, and n=85 respectively. No participant was found with hypervitaminosis D. Insufficient level of vitamin D was determined in female (67.5%) patients as compared to males (43.9%) (Table 2).

Table 2: Distribution of Vitamin D levels in males and females (n=195)

Vitamin D Level	Gender Groups		
	Male % (n)	Female % (n)	Total % (n)
Deficiency <10 IU	7.7 (12)	7.5 (03)	7.7 (15)
Insufficient 10-30 IU	43.9 (68)	67.5 (27)	48.7 (95)
Normal 30-100 IU	48.4 (75)	25.0 (10)	43.6 (85)
Hypervitaminosis D/Toxicitity >100 IU	0 (0)	0 (0)	0 (0)
Grand Total	79.5 (155)	20.5 (40)	100 (195)

Vitamin D level was also determined in different age groups. The highest prevalence of vitamin D insufficiency was obtained in the age group 16-25 years, followed by the age group 36-45 years, and then the 26-35 years age group. Hypovitaminosis D was found more in the age group 36-45 years (Table 3).

Table 3: Distribution of Vitamin D level in different age groups (n=195)

Vitamin D Level	Age Groups (Years)					
	16-25 % (n)	26-35 % (n)	36-45 % (n)	46-55 % (n)	55-65 % (n)	Total % (n)
Deficiency <10 IU	02	02	11	0	0	7.7 (15)
Insufficient 10-30 IU	45	16	31	02	01	48.7 (95)
Normal 30-100 IU	04	39	15	22	05	43.6 (85)

DISCUSSION

Hypovitaminosis D is a reported pandemic both in developed and underdeveloped countries. Sunlight is a major source of vitamin D and only a few natural foods are enriched with vitamin D. Hypovitaminosis D is more frequently found in Middle East and South Asian countries[26]. Hypovitaminosis D affects more than 50% population throughout the world and is considered an important public health issue, particularly in developing countries including Pakistan[27].

In our study, 56.4% of individuals suffered from low vitamin D levels (Deficiency and insufficient). Riaz et al. published their data of high sample size (n=4830), in which findings were consistent with this study finding that 53.5% had Hypovitaminosis D and 31.5% were insufficient with vitamin D[28]. Our reported prevalence is much lower than the study reported in which 90% of healthy volunteers were affected by the low level of vitamin D (insufficiency and deficiency)[22]. Similar to the present study findings, Chaudhary et al., also revealed that females are more susceptible to Hypovitaminosis D as compared to males[29].

In the present study, all patients were categorized into different strata in which the most common Hypovitaminosis D was found younger age group individuals. Similar to our findings, Chaudhary et al., also found that younger age group individuals than 50 years are frequently vulnerable to Hypovitaminosis D than older age individuals[29].

A study from Afghanistan reported a significant relationship between gender differentiation and level of vitamin D[30]. A report from Lahore also revealed an 81% Hypovitaminosis D in females[15]. Present reported proportion is lower than the proportion reported by Zargar et al., from Kashmir, India which shows an 83% deficiency of vitamin D[31]. Hypovitaminosis D is more in female and young age people as compared to male and old age people. This Hypovitaminosis D is a great risk which further leads to severe complications. Similar to our study, Azizi et al., from Afghanistan reported that females are more susceptible to Hypovitaminosis D than male individuals[30]. Similarly, other studies also found like our findings from regions[32] of the world[33]. Studies show from Kashmir and other regions[34] of the world show greater prevalence in females[31, 35], which could be explained by less exposure to sunlight, decreased body area exposure, and fewer outdoor activities than male individuals[22]. A higher prevalence of Hypovitaminosis D may be due to ignoring sunlight due to religious factors (to cover the whole body), fear of darkening of the skin, and traditionally to expose hands and face in the female population for outdoor visits[36]. Another study reported that sunscreen and heavy clothes/fabrics usage are significantly associated with Hypovitaminosis D[37].

The prevalence of Hypovitaminosis D prevalent in male and female are contradictory throughout the world. On the other side, some studies show that vitamin D concentration are found greater in women as compared to men[38]. Moreover, a study from Saudi Arabia reported that Hypovitaminosis D was found in 70% of male populations as compared to females[39]. A study from the United States (US) revealed that Hypovitaminosis D is higher in males individuals than females patients[40, 41]. Which is explained b a higher body mass index, and less consumption of milk[22]. Additionally, the male subjects also avoid sunlight exposure due to misconceptions related to the harmful effects of sunlight, high temperatures in summer in some parts of the world, or lack of awareness regarding the role of vitamin D in body growth and metabolism[36].

In the present study, younger individuals are more vulnerable to Hypovitaminosis D, which may be explained by less consumption of vitamin D-containing foods including oily fish and fortified cereals. Hypovitaminosis D in Pakistan like the developing country is more prevalent due to insufficient dietary supplemented foodstuffs, resulting in low dietary intake of vitamin D[22]. Hypovitamniosis D have several long term consequences including the diabetic nephropathy[42].

Another hypothesis shows that air pollution is another factor that prevents ultraviolet exposure to the skin due to the high level of troposphere ozone. Pakistan is one of the polluted countries, therefore pollution could be another factor[43]. In a few studies, the high percentage of Hypovitaminosis D was attributed to dietary factors[18, 21], air pollution[44], clothing[21, 45], and avoidance of sunlight exposure[46].

The study was conducted on small scale and was a cross-sectional study including only approximately 20% female population with a convenient sampling technique. Blood samples were collected at a single point time and no follow-ups were collected, due to limited financial status, therefore no information was gathered regarding the long-term effects of Hypovitaminosis D. Daily intake of Vitamin D was also not determined due to several reasons. Seasonal/overcast and rainy days can affect vitamin D levels which were not studied. Lifestyle factors and serum parathormone levels were also not checked due to limited resources. Control group and comparison between urban and rural areas people is required to understand the scenario of Hypovitaminosis D.

CONCLUSION

This study shows a higher proportion of Hypovitaminosis D in female and younger age individuals. This increases the risk of developing chronic conditions associated with immunity, and reproductive and musculoskeletal systems. It is important to educate the public regarding the vitamin D role in our health, to avoid any severe complications. A suitable lifestyle and optimum sunlight exposure can prevent Hypovitaminosis D levels. Hence clinical trials and interventional studies are highly necessary to obtained appropriate levels, doses, and affect of supplements of vitamin D. To combat Hypovitaminosis D, it is highly crucial to intake vitamin D-rich food at a high level, increase sunlight exposure, and start food fortification enriched with level of vitamin D.

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