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A Single Center Report of Vitamin D Deficiency among Young Orthopaedic Patient in Iran

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Authors' contributions

This work was carried out in collaboration among all authors. Authors AY, BO, M. Moghtadaei, APS, M. Mahdavi and SH made substantial contributions to conception and design, analysis and interpretation of data and contributed to sample collection. All authors were involved in drafting the manuscript and revising it. All authors read and approved the final manuscript.

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ABSTRACT

Background: Orthopaedic patients are at risk of having irregular levels of vitamin D and calcium due to lack of motility and sun light exposure. Among entire population of patients, Juvenile members of society are considered high-risk groups for vitamin D inadequacy. By considering the high prevalence of this complaint according to domestic studies in Iran, this study aims to provide a report of vitamin D and related factors among orthopaedic patients in Iran.
Methods: Participants were selected based on simple non-probable sampling method. Variables were including age, gender, the serum level of vitamin D, calcium, phosphorus, concurrent diseases, and history of taking nutritional supplements. Results were analysed using SPSS software (version 22, USA).
Results: 696 patient with mean age 15.5±1.8 were involved among which 440 participants were male and 256 cases were female. Mean of vitamin D calcium, phosphorous serum level was

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12.1±4.3, 9.7± 0.5 and 4.3±0.8 respectively. 208 cases were living at urban and 488 members were living at rural locations. 176 cases had degrees of muscular pain, and 72 patients were suffering from developmental problems, and 32 patients were presenting obvious skeletal deformities.
Conclusion: Vitamin D deficiency is a common issue among orthopaedic patients. Young patients are in a high danger for consequence of vitamin deficiency in orthopaedic ward due to critical age of bone formation and growth.

Keywords: Vitamin D; calcium; phosphorus; orthopaedic ward; solar UVB exposure.

1. INTRODUCTION

Vitamin D which is mostly known as the sunshine vitamin, is a prohormone in the body that has proven to be involved in diverse array of biological processes [1]. Although this substance is considerably rare in nutrition, some foods including fish, egg and dairy products account for considerable resources [2]. It is assumed that major source of this micronutrient is solar UVB exposure. Upon this exposure, a reaction starts in which a precursor converts to an active metabolite 1,25-dihydroxyvitamin which in turn builds up vitamin D [3,4]. As it has been stated by earlier studies, liver, and kidney play pivotal roles in vitamin D production [5]. Considered a hormone-like substance, this vitamin exerts its role as a ligand and activates cellular receptors which could result in different cellular responses [6].

Due to the undeniable role of vitamin D in the absorption of mineral elements including calcium, phosphor, measuring levels of calcium, phosphor and alkaline phosphatase are used as an indirect method to determine serum 25-hydroxyvitamin D [25(OH)D] levels [7-9]. It should be noted that some critical age group need special consideration toward vitamin D deficiency [10].

It is beyond doubt that vitamin D deficiency shall be a concern among orthopaedic patients due to their lack of motility and high demand for bone formation. Until know researches have been conducted on evaluating vitamin D deficiency among orthopaedic patients [11,12]. Considering the fact that high prevalence of vitamin D deficiency among orthopaedic patients in recent study, there is a need for through investigation of vitamin D and related factors among orthopaedic patients.

In this current study, we decided to focus on young orthopaedic patients admitted in orthopaedic wards of Iranian hospitals. Younger members of society admitted in orthopaedic ward need more careful attention about vitamin D and calcium because of exacerbated condition, need for bone formation and irregular serum levels of mentioned nutrients due to receiving orthopaedic drugs (drugs which interfere with vitamin D metabolism through activation of the pregnane X receptor such as Antibiotics (Clotrimazole, Rifampicin); Anti-inflammatory agents (Dexamethasone); Antineoplastic drugs (Cyclophophamide, Taxol, Tamoxifen) etc). In current study along with prevalence and symptoms, a group of factors related to deficiency were analysed too.

2. MATERIALS AND METHODS

2.1 Study Designing and Participant Selection

This study was carried out from 2005 to 2018 and 696 patients were participated from different hospitals (both private and governmental) of Tehran (Iran) who agreed to cooperate with Iran University of Medical Sciences. Data were collected from volunteer participants using checklists of predefined variables. All the participants involved in this study were under 20 years' old whom admitted to orthopaedic wards because of musculoskeletal problems. Selecting participants was carried out based on non-probable sampling method. All participants, parents and guardians received information about the study and willingly agreed and signed informed written consent. After approval of participation, demographic data were recorded in each patient's checklist which was designed focusing on information regarding age, gender, weight, BMI, socioeconomically level. A 10cc blood sample was drawn from each patient and was sent to the hospital's central lab for studying the parameters (the serum level of vitamin D, calcium, phosphorous, and potassium) and results was added to the checklist.

At this study serum 25-hydroxyvitamin D [25(OH)D] levels lower than 10 ng/ml, between

10 to 30 ng/ml, and above 30 ng/ml were considered deficient, insufficient, and normal respectively.

2.2 Exclusion Criteria

Patients older with age 20≤ were excluded and those who were admitted by other wards than orthopaedic were also crossed out of study. Non-volunteers were also omitted and no pressure by hospital or medical team was opposed on them.

2.3 Analysis of Data

After final confirmation of data gathered by checklists, statistical analyses were performed using SPSS (version22, USA). Core statistical indices including mean, middle, and Standard deviation were determined. A few cases of complimentary checks including the chi2 test were required.

3. RESULTS

Finally, 696 patients with vitamin D deficiency were entered into the study. Mean of age at this study was 15.5±1.8 among which min and max of age were 12 and 19 years old. Among these patients 440 patients (63.2%) were male and 256 patients (36.8%) were female.

Body mass index (BMI) of the studied population was 22.4 ± 2.7 and 120 patients (17.2%) had a history of taking nutritional supplements.

From the socioeconomic point of view, 120 cases (17.2%) were at low level, 424 participants (60.9%) were middle and 152 others (21.8%) were at high level. From the perspective of living condition, 208 patients (29.9%) were living at urban and 488 patients (70.1%) were residing in rural.

According to data provided by the current study, 216 patients (31%) had concurrent diseases and 480 cases (69%) had no underlying malady.

176 patients (25.3%) had degrees of muscular pain and at 72 patients (10.3%) were dealing with obvious growth retardation and 32 patients (4.6%) were suffering from skeletal deformities. Table 1 displays demographic data of the population for this study.

Mean of 25(OH) D level at studied patients was 12.1 ± 4.3 with min and max 2.2 and 24 ng/ml. calcium level was 9.7 ± 0.5 ng/ml with min and max 7.9 and 11 ng/ml conjointly. Phosphorous serum level among studied cases was 4.3 ± 0.8 ng/ml with min 2.4 ng/ml and max 5.5 ng/ml. Table 2 demonstrates micronutrients serum level investigated in this study.

Table 1. Demographic variables of study population (n = 696)

Variable		Value
Age (mean ±SD)		15.5±1.8
Gender	Male (%)	440 (63.2%)
	Female (%)	256 (36.8%)
BMI (mean ±SD)		22.4 ± (2.7)
Supplement intake		120 (17.2%)
Residential	Urban (%)	208 (29.9%)
	Rural (%)	488 (70.1)
Socioeconomic level	Low (%)	120 (17.2%)
	Middle (%)	424 (69.9%)
	High (%)	152 (21.8%)
Comorbidity (%)		216 (31%)
Current disease	Muscular pain	176 (25.3%)
	Growth retardation	72 (10.3%)
	Skeletal deformity	32 (4.6%)

Table 2. Micronutrients serum level of study population (n = 696)

Micronutrients	Serum level (Mean ng/ml)
Ca	9.7±0.5
P	4.3±0.8
Vit D	12.1±4.3

4. DISCUSSION

Vitamin D deficiency is a growing concern in Iran. The study by Rabbani et al. states that average 32% of Iranian boys and girls are suffering from vitamin D deficiency in Iran [13]. Childhood and adolescence are critical times for vitamin D deficiency due to the need for calcium absorption, growth and bone formation. Admission in orthopedic ward could affect levels of vitamin D and Calcium because of lack of mobility and reduced sunlight exposure along with taking orthopadic drugs.

Previous studies have proved the high prevalence of vitamin D deficiency among juveniles, and serious side effects have been reported [14,15]. The demise of muscular strength, rickets, falling and bone fracture, high risk of growth retardation are among complications requiring more attention [16,17]. In regard to high prevalence of vitamin D deficiency according to domestic studies and correlation with numerous well known consequences among juveniles [18], it was necessary to design a study to evaluate demographic changes of this malady among Iranian juveniles admitted to hospital.

There is a preconception that Vitamin D deficiency in Islamic countries like Iran should be prevalent among females. According to a meta-analysis study by Tabrizi et al. pooled prevalence of vitamin D deficiency among Iranian women was estimated to be considerably high [17]. It seems that inappropriate diet, inadequate sunlight exposure due to hijab and having more inside activities than outdoor work could be a reason for having lower levels of vitamin D compared to men [19]. In the current study, we found that low levels of vitamin D are more common among males. At first, it seems simply because of sampling method, but another reason might be that Iranian girls, especially in rural locations, have more outdoor activities at young ages and after marriage, these activities would be more restricted. Also, hijab clothing is more obligated among adults than children. Another reason that really needs more study is different effects of orthopadic drugs on different genders and analysing males and females separetely.

It is important to define the threshold of vitamin D deficiency because it impacts on epidemiologic researches and changes demographic features and statistical prevalence. Many scientists still believe that levels under 30 ng/ml should be considered as vitamin D deficient [20] and this study also used the same criteria for deficiency and inadequacy.

Musculoskeletal problems of children are not only due to insufficiency of vitamin D, but also lack of calcium, Phosphorous, and other related factors. In this study it was found that these factors were also in low levels among suffers of vitamin D inadequacy who were admitted in orthopedic ward.

Socioeconomic condition, place of inhabitance and tradition are also of high importance in vitamin D levels. These factors can affect individuals by having impact on sunlight exposure and diet before admission to hospital. From the socioeconomic perspective, we found that deficiency is higher among middle groups, but we had cases at both edges which means that this problem is not absolutely dependent on monetary status. It's also seems important to state that in spite of the preconception that "those who live in rural have enough vitamin D because of sunlight exposure" we found that a considerable group of sufferers (70.1%) were coming rural locations. Among urban population there is almost no difference in solar UVB exposure between boys and girls, but metabolic demand for vitamin D is higher among boys. The difference witnessed could also be due to receiving usual drugs prescribed in orthopedic ward. Also most of those coming from rural did not use seafood in their home because they having restricted access to these kind of food.

According to data provided by the current study it seems that monitoring the serum level of vitamin D among young patients in orthopedic ward is of vital importance. The sooner that problem is identified, the more effective corrective actions could be taken, and consequently the results will be more satisfying [21]. Preventive measurements including the use of vitamin D supplements besides calcium could be helpful to prevent complications related to vitamin D deficiency, especially at young ages.

5. CONCLUSION

In high risk populations, Serum 25-hydroxyvitamin D [25(OH)D] and calcium deficiency should be recognized earlier to be provided with a better plans including food supplements and sunlight exposure.

CONSENT

For participating in experiment, informed written consent was taken from participants or their guardians.

ETHICAL APPROVAL

The study had been approved by Rasool-e-Akram Hospital, Trauma and injury research center at Rasool-e-Akram Hospital, Iran University of Medical Science, Tehran, Iran (under the registration No.IUMS1394-7) and moral aspects were accepted by moral committee of this center. We followed Helsinki protocol in current study.

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COMPETING INTERESTS

Authors state no conflict of interest that can negatively affect the presented study.

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