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Impact of Vitamin D Deficiency on Physical and Mental Health in OPD Patients- A Tertiary Care Hospital Study

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Abstract **Original Research Article**

Introduction: In general vitamin D deficiency is widespread due to the lacking of inadequate supplements and sunlight consumption. Accessible literature is contradictory for the function of vitamin D supplementation in depression. We targeted the research to evaluate the vitamin D deficiency and its provable relation with several physical and mental health problems. ***Objective:*** The objective of this study was to evaluate the incidence and correlation between vitamin D deficiency and the sufficiency of people. ***Methods:*** It was a comparative observational study that was conducted during the period from January 2019 to December 2019. A total of 112 patients attended the OPD of Tertiary Care Hospital, Dhaka, Bangladesh with several illnesses were consecutively evaluated for vitamin D deficiency and related physical and mental health conditions. Ethical clearance was taken from the concerned hospital. Properly written consent was taken from all the participants before starting data collection. Data were analyzed in SPSS version 20.0. ***Results:*** In this study in the vitamin D sufficiency group participants, the prevalence of physical disease was 28.57% and it was found 63.89% among the participants of the vitamin D deficiency group. In the vitamin D sufficiency group participants, the prevalence of mental disease was found at 14.29% and it was found 33.33% among the participants of the vitamin D deficiency group. According to the assessment regarding the frequency of osteoarthritis, cardiovascular disease, hypertension, diabetes, osteoporosis, erectile dysfunction, dental disease, immune system disorders, multiple sclerosis, and cancer (Physical diseases), there was not a significant correlation between the series of vitamin D sufficiency and vitamin D deficiency groups where the P-value was found 0.318. On the other hand, according to the assessment regarding the frequency of anxiety disorder, depressive disorder, insomnia, dementia, bipolar disorder, and Parkinson's disease (Mental diseases), there was found a significant correlation between the series of vitamin D sufficiency and vitamin D deficiency groups where the P-value was found 0.036. ***Conclusions:*** According to the findings of this study we can conclude that there may some relation between mental disorders and vitamin D deficiency in the human body. The frequency of bone-related diseases and disorders is found higher in patients with vitamin D deficiency.

Keywords: Impact, Vitamin D deficiency, physical, mental health, depression.

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INTRODUCTION

In general vitamin D deficiency is widespread due to the lacking inadequate supplements and sunlight consumption. Accessible literature is contradictory for the function of vitamin D supplementation in depression. Physical inactivity has been identified as the fourth leading risk factor for global mortality, while overweight and obesity are in the fifth place [1]. Vitamin D deficiency is associated with health problems including diabetes mellitus, the metabolic syndrome, cancer, pulmonary diseases, and significant myopathy [2]. Regarding myopathy, the knowledge about the impact of vitamin D on muscle morphology and functioning in elderly is increasing. Several studies in elderly report a positive relationship between vitamin D status and physical performance [3] and evidence that vitamin D supplementation improves physical performance [4]. However, other studies failed to show a significant effect of vitamin D supplementation on muscle strength [5]. Knowledge and awareness about vitamin D and muscle function in a younger adult population is limited. Vitamin D supplementation

increased muscle power in young Arabic women and improved physical performance in a small trial in 40 healthy volunteers with hypovitaminosis D, but not all studies showed an effect [6]. Vitamin D is an essential vitamin which is necessary for bone metabolism, calcium and phosphorus metabolism, muscle functioning. In the body Vit D is produced by sun exposure or obtained from food in various concentrations [7]. There is great number of factors which leads to deficiency of vitamin in person with mental illness. They could be due to diet poor in vitamin or poor exposure to sunlight or interference with formation of vitamin from sunlight [medication, smoking or alcohol] [8]. As per US Endocrine Society practical guidelines vitamin D deficiency is defined as serum 25-OH D <50 nmol/l or below 20 ng/ml] and Vit D insufficiency is defined as serum levels of 25-OH D ranging between 50 to 75 nmol/l [21–29 ng/ml] [9]. A study from US population has been reported to be 37.5% is the Vitamin D prevalence in population. They are associated with metabolic, neoplastic and immunological disorders such as atherosclerosis, diabetes mellitus and colon cancer [10]. There are few studies showing Vitamin D plays a major role in maintaining mental health, human emotions and cognitive functions [11]. As per the study patients with low vitamin D levels suffer from mood disorders [12]. Ganji V etc 2010 and Annweiler C etc. 2010 studies have shown relationships between vitamin D deficiency and depressive symptoms or cognitive impairment [13]. Vitamin D deficiency is associated with Parkinson's disease, schizophreniform disorder, multiple sclerosis [MS], alzheimer's disease and autism spectrum disorders [14]. Vitamin D supplementation during early fetal growth and early childhood was shown to have a positive effect on brain [15].

OBJECTIVES

General Objective

- To evaluate the incidence and correlation between vitamin D deficiency and sufficiency people.

Specific Objective

- To assess the vitamin D status of patients with several physical and mental health problems.
- To assess the frequencies of several physical and mental diseases among patients with several vitamin D statuses.

METHODS & MATERIALS

This comparative observational study which was conducted during the period from January 2019 to December 2019. A total of 112 patients attended to the OPD of a Tertiary Care Hospital, Dhaka, Bangladesh with several illnesses were consecutively evaluated for vitamin D deficiency and related physical and mental health condition. Ethical clearance was taken from the concerned hospital. Proper written consents were taken from all the participants before starting data collection. The data regarding socio-demographic factors; primary mental diagnosis; vitamin D serum concentrations and other variables of the phosphocalcic metabolism; prolactin serum levels; body weight, height and body mass index (BMI); normal diet (as indicated by at least two meals per day); normal physical activity (as indicated by aerobic activity >20min at least 2 days per week); smoking cigarettes; clinical comorbidities were collected. This study was approved by the ethical committee of the mentioned hospital. We eliminated confounding illnesses that may contribute to low vitamin D concentrations such as malnutrition (feeding difficulties and/or wasting syndrome due to medical causes) or malabsorption (celiac disease, inflammatory bowel disease, exocrine pancreatic insufficiency from cystic fibrosis and/or short intestine syndrome). Subjects with metabolic bone diseases (such as osteoporosis, rickets, osteomalacia, osteopetrosis, Paget disease of bone, and fibrous dysplasia) and pathological hyperprolactinemia not medication caused (such as pituitary micro and macro adenomas, prolactinoma, chronic renal failure, and patients on hemodialysis) were likewise eliminated. Descriptive data were utilized to summarize the participant characteristics. Contestants were then separated into three categories based on their vit d Levels: (1) vit D deficiency (vit D levels <10ng/ml); (2) vit D insufficiency (vit D levels = 10–29.99ng/ml); (3) vit D adequacy (vit D levels greater ≥30ng/ml). The three groups were compared with chi-square tests on categorical variables such as gender, physical activity, smoke, diagnosis (bipolar illness vs. other illnesses), season (other seasons vs. summer) and drug treatment, and with Kruskal-Wallis test on quantitative variables (age, BMI, PRL, Magnesium, Calcium, Phosphorus, Alkaline phosphatase, and PTH) because they showed a non-normal distribution, as evaluated using Shapiro-Wilks test. The significance level was set at $p<0.05$. Variables that diff ered significantly among the three groups of vitamin D levels were entered as autonomous factors in a logistic regression model with a forward stepwise procedure. In this model, vitamin D was used as a dependent variable, coded as deficiency vs. no deficiency. Physical and mental health problems were compared between vitamin D sufficiency (Normal) and deficiency group's patients. Data were analyzed in SPSS version 20.0.

RESULTS

In this study among total 112 participants 36.6% were male whereas 63.4% were female. So female was dominating in number and the male-female ratio was 1:1.73. According to the ages of the participants we observed, the highest number of participants was from 21-40 years' age group which was 35.7%. Besides this, 9.8%, 31.3% and 23.2% participants were from 'up to 20', 41 – 60 and >60 years' age groups respectively. The mean (±SD) age of the participants was 44.97±18.36 years. In analyzing the vitamin D levels of the participants, we observed 37%, 32% and the rest 31% participants were with vitamin D insufficiency, deficiency and sufficiency respectively.

In this study, the highest number of participants with vitamin D deficiency were found in 21-40 years' age group which was in 38.9%, the highest number of participants with vitamin D insufficiency were found in 21-40 years' age group which was in 46.3% and the highest number of participants with vitamin D sufficiency were found in >60 years' age group which was in 48.6%. In this study the mean (±SD) vitamin D status in ng/mL were found 27.58±13.19, 24.51±8.26, 25.14±11.58 and 36.99±15.66 ng/mL in 0 – 20, 21 – 40, 41 – 60 and >60 years' age groups respectively. We found significant correlation between vitamin D status and the ages of the participants (P=0.002). In this study in vitamin D sufficiency group participants, the prevalence of physical disease was found 28.57% whereas it was found 63.89% among the participants of vitamin D deficiency group. On the other hand, in vitamin D sufficiency group participants, the prevalence of mental disease was found 14.29% whereas it was found 33.33% among the participants of vitamin D deficiency group. According to the assessment regarding the frequency of osteoarthritis, cardiovascular disease, hypertension, diabetes, osteoporosis, erectile dysfunction, dental disease, immune system disorders, multiple sclerosis and cancer (Physical diseases) there was not significant correlation between the series of vitamin D sufficiency and vitamin D deficiency groups where the P value was found 0.318. On the other hand, according to the assessment regarding the frequency of anxiety disorder, depressive disorder, insomnia, dementia, bipolar disorder and parkinson's disease (Mental diseases) there was found significant correlation between the series of vitamin D sufficiency and vitamin D deficiency groups where the P value was found 0.036.

Table-I: Demographic characteristics of the participants (112)

Characteristics	n	%	Mean ±SD
Age in years			
Up to 20	11	9.8	44.97±18.36
21 - 40	40	35.7	
41 - 60	35	31.3	
>60	26	23.2	
Gender			
Male	41	36.6	
Female	71	63.4	

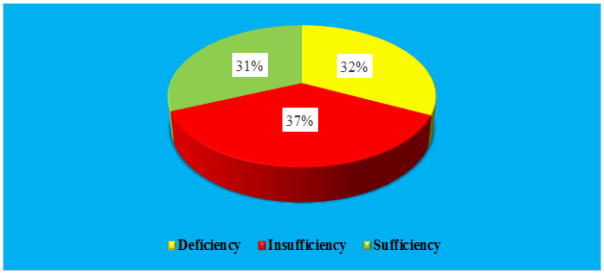

Fig-I: Vitamin D levels among participants (112)

(Deficiency: <20 ng/mL, Insufficiency: 21-29 ng/mL and Sufficiency: 30-100 ng/mL)

Table-II: Vitamin D status in age groups of the participants (112)

Age (yrs.)	Vitamin D					
	Deficiency		Insufficiency		Sufficiency	
	n	%	n	%	n	%
Up to 20	4	11.1	3	7.3	4	11.4
21 - 40	14	38.9	19	46.3	7	20
41 - 60	13	36.1	15	36.6	7	20
>60	5	13.9	4	9.8	17	48.6

Table-III: Mean vitamin D status in ng/mL in different age groups of the participants (112)

Age (yrs.)	Vitamin D Level				P Value
	n	Mean ±SD	95% Confidence Interval		
			Lower Bound	Upper Bound	
Up to 20	11	27.58±13.19	18.72	36.44	0.002[s]
21 - 40	40	24.51±8.26	21.86	27.15	
41 - 60	35	25.14±11.58	21.17	29.12	
>60	26	36.99±15.66	30.67	43.32	

(s=significant; ns=not significant)

Table- IV: Prevalence of physical and mental diseases among vitamin D sufficiency & deficiency groups (112)

Disease & disorder	Sufficiency Gr. (n=35)		Deficiency Gr. (n=36)		Total (n=71)		P value
	n	%	n	%	n	%	
Frequency of physical disease/disorders							
Osteoarthritis	0	0.0	4	11.11	4	5.63	0.318
Cardiovascular disease	0	0.0	3	8.33	3	4.23	
Hypertension	4	11.43	3	8.33	7	9.86	
Diabetes	3	8.57	4	11.11	7	9.86	
Osteoporosis	1	2.86	2	5.56	3	4.23	
Erectile dysfunction	0	0.0	3	8.33	3	4.23	
Dental disease	1	2.86	2	5.56	3	4.23	
Immune system disorders	0	0.0	1	2.78	1	1.41	
Multiple sclerosis	1	2.86	1	2.78	2	2.82	
Cancer	0	0.0	0.0	0.0	0.0	0.0	
Total	10	28.57	23	63.89	33	46.48	
Frequency of mental disease/disorders							
Anxiety disorder	2	5.71	4	11.11	6	8.45	0.036
Depressive disorder	1	2.86	3	8.33	4	5.63	
Insomnia	1	2.86	2	5.56	3	4.23	
Dementia	0	0.0	1	2.78	1	1.41	
Bipolar disorder	1	2.86	1	2.78	2	2.82	
Parkinson's disease	0	0.0	1	2.78	1	1.41	
Total	5	14.29	12	33.33	17	23.94	

DISCUSSION

The objective of this study was to evaluate the incidence and correlation between vitamin D deficiency and sufficiency people. Various issues may explain why some trials did not find any effect of supplementation, including a relatively small increase in serum 25(OH) D, a normal vitamin D status at baseline, exceptionally good physical function [16], and the confounding effects of training [5]. In a trial by Wicherts et al. there were no between-group or within-group differences in the chair stand test and handgrip strength after 6 months of vitamin D supplementation in participants with a mean age of 41.3 years. In this study, however, vitamin D supplementation was compared with sunshine exposure advice and there was no control group [17]. Besides this, Gupta et al. reported a significant enhancement of muscle strength and a gain of 16 m on the 6-MWT after 6 month's supplementation with vitamin D3 and calcium in a study population aged 20 to 40 years. Despite their smaller study population, they had less variation in the test scores in the 6-MWT. Moreover, they applied a higher dose of vitamin D (60 000 IU D3/week for 8 weeks followed by 60 000 IU/month for 4 months), resulting in higher serum 25(OH) D values after 2 months [18]. In a trial of Norway, not all participants were vitamin D deficient at baseline and only 57% in the 1000 IU supplementation group and 38% in the 400 IU group reached 25(OH) D concentrations R50 nmol/l [6]. Bischoff et al. [19] were the first to report the detection of the VDR in human muscle cells. A recent study, however, did not find VDR expression in skeletal muscle [20]. However, several other trials investigating the effect of vitamin D supplementation on physical performance had a lower or comparable number of subjects [5]. In our study, according to the ages of the participants we observed, the highest number of participants was from 21-40 years' age group which was 35.7%. Besides this, 9.8%, 31.3% and 23.2% participants were from 'up to 20', 41 – 60 and >60 years' age groups respectively. The mean (±SD) age of the participants was 44.97±18.36 years. Compared to the general population our study displays high prevalence of Vitamin D Deficiency in patients suffering with mental illness. Our results are also showing similar reported compared to other studies and indicate that Vitamin D deficiency much higher in patients with psychiatric illness than in the general population [21]. In a study they claimed, vitamin D activates receptors on neurons which are located in regions that are implicated in human behavior regulation; it releases neurotrophin from cells and protects the brain by enhancing antioxidant and anti-inflammatory defenses against vascular injury [22]. It is well-known that the main reason for vitamin D deficiencies are reduced sunlight exposure reduced dietary intake, smoking, and lack of physical exercise [7]. Many studies have shown that a patient with depression and schizophrenia illness smoke tobacco [Self-medication theory] very often, run a sedentary lifestyle, and practices unhealthy dietary habits [23]. In our study in vitamin D sufficiency group participants, the prevalence of physical disease was found 28.57% whereas it was found 63.89% among the participants of vitamin D deficiency group. On the other hand, in vitamin D sufficiency group participants, the prevalence of mental disease was found 14.29% whereas it was found 33.33% among the participants of vitamin D

deficiency group. Like any other studies our study does have some limitations.

CONCLUSION

According to the findings of this study we can conclude that there may some relation between mental disorders and vitamin D deficiency in human body. The frequency of bone related diseases and disorders are found higher in patients with vitamin D deficiency. Health policy makers should be aware about tendering proper knowledge and awareness to the healthcare service provider people and institutions. This was a single centered study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country. For getting more reliable information we would like to recommend for conducting more studies in several places with larger sized samples.

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