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Comparison of Vitamin D Levels in Elderly Population Versus Young Adults

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Abstract:
Introduction: Advancing age brings about socioeconomic, lifestyle and biological changes.This is also associated with deterioration in the functioning of various organs like kidney. This may affect the final step of vitamin D activation resulting in vitamin D deficiency. There is a need to evaluate the strength of association between vitamin D status and age. The aim of the study was to compare vitamin D levels in elderly with young adults and also to find the association of age and vitamin D levels.
Methodology: Data of Vitamin D levels of 73 elderly patients (>60 years) as cases and 88 patients who were <60 years of age as controls , who visited clinical biochemistry laboratory for sampling was collected. 25-OH vitamin D was estimated in clinical Biochemistry laboratory using Cobas e411 which works on the principle of electro chemiluminescence. Data was analyzed using the software SPSS 16 .
Results: A significantly low vitamin D levels were observed in elderly (p=0.003). Linear regression analysis showed a significant positive association between age and vit D levels (p=0.007).
Conclusion: Elderly population had a low vitamin D levels compared to younger population. This study suggests supplementation of elderly people with vitamin D may be beneficial.
Key words: *vitamin D, elderly individuals, young adults*

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I. Introduction

Structural and functional changes of kidneys have been reported in elderly. Degenerative changes occur in kidneys resulting in reduction in their size and weight ,which in turn leads to increased cortical glomerulosclerosis (1).Due to these reasons, aging may affect the formation of 1,25-dihydroxyvitamin D (1,25[OH]2D; calcitriol), the active form of vitamin D. Production of 1,25(OH)2D may be reduced as a result of an age-related decline in renal function . Aging causes a decrease in calcium absorption that precedes the decrease in 1,25(OH)2D by 10 to 15 years. The development of vitamin D deficiency leads to further reduction in the formation of 1,25(OH)2D.

As ageing is associated with diminished renal functions, the final step of vitamin D activation may be affected resulting in vitamin D deficiency. There is a need to evaluate the strength of association between vitamin D status and age. So this study is designed to compare vitamin D levels in elderly with young adults and also to find the association of age and vitamin D levels. There are not many such studies in Indian settings to the best of our knowledge.

Vitamin D is derived from diet and sunlight and is not biologically active. Vitamin D must be sequentially converted into 25-hydroxyvitamin D (25OHD) in the liver then into 1,25-dihydroxyvitamin D (1,25[OH]2D) in the kidney by the enzyme ,1α hydroxylase . Both 1,25(OH)2D and 25(OH)D are carried in the circulation by vitamin D–binding protein (DBP). 1,25(OH)2D is essential for the efficient absorption of dietary calcium and phosphorus and for mineralization of bone. 1,25(OH)2D has also been recognized to have a multitude of other biologic functions.

Studies have reported that malabsorption of calcium occurs as part of aging and starts at approximately age 65 to 70 years (2,3). As a result, it leads to negative calcium balance, secondary hyperparathyroidism, increased bone loss, and osteoporosis. It is a known fact that vitamin D helps in calcium absorption by synthesizing a calcium binding protein called calbindin.Studies suggests that in aged individuals, deletion of the vitamin D receptor (VDR) gene results in malabsorption of calcium(4). In young healthy people, there is a positive correlation between calcium absorption and serum 1,25(OH)2D, but in older people and patients with osteoporosis, the calcium absorption response is lower relative to serum 1,25(OH)2D than in young people suggesting intestinal resistance to endogenous circulating 1,25(OH)2D (5,6).

As renal function declines with age, there may be a decrease in the activity of the renal enzyme 1α hydroxylase that converts 25OHD into 1,25(OH)2D. So there may be a deficiency of vitamin D in the elderly. Study by Mosekilde et al has reported vitamin D deficiency or insufficiency in elderly population(7).The study also suggests a need to supplement regular vitamin D and calcium to reduce fracture risks in elderly. Similar reports were given by Barbara et al (8).Research has found an extraordinarily high prevalence of vitamin D deficiency afflicting over half of certain elderly populations and an unexpected 30% of healthy young adults (9,10).

Hypothesis: Vitamin D levels may be low in elderly people as compared to young adults and age may bear a negative correlation with vitamin D levels.

Objectives:

1. To compare vitamin D levels in elderly population with that in young adults.
2. To find the correlation between Vitamin D levels and age.

II. Methodology

Study Design

The retrospective study was conducted in the Department of Clinical Biochemistry, KS Hegde Medical Academy , Mangaluru. Data of patients visiting clinical biochemistry laboratory for vitamin D testing was collected. The study was approved by the institutional ethics committee.

Study Population: Data of Vitamin D levels of 73 elderly patients (>60 years) as cases and 88 patients who were <60 years of age as controls , who visited clinical biochemistry laboratory for sampling was collected. Institutional ethics committee approval was obtained (INST.EC/EC/019/2018-19).

Inclusion criteria: Patients visiting clinical biochemistry laboratory for vitamin D testing

Exclusion Criteria : Those on vitamin D supplementation, renal and liver disorders

25-OH vitamin D is estimated in clinical Biochemistry laboratory – Roche, Cobas e411 which works on the principle of electro chemiluminescence.

Data was collected over a time period of 4 months, from January – April 2018.

Statistical Analysis

data was analyzed using the software SPSS 16. The entered data was verified and checked for data errors during coding and data entry. Descriptive statistics was used for calculating mean, standard deviation.Mann Whitney U test was used for comparing vit D levels. Linear regression analysis was used to find the correlation of vitamin D and age.

Results

A significantly low vitamin D levels were observed in elderly (Table 1,Fig 1).

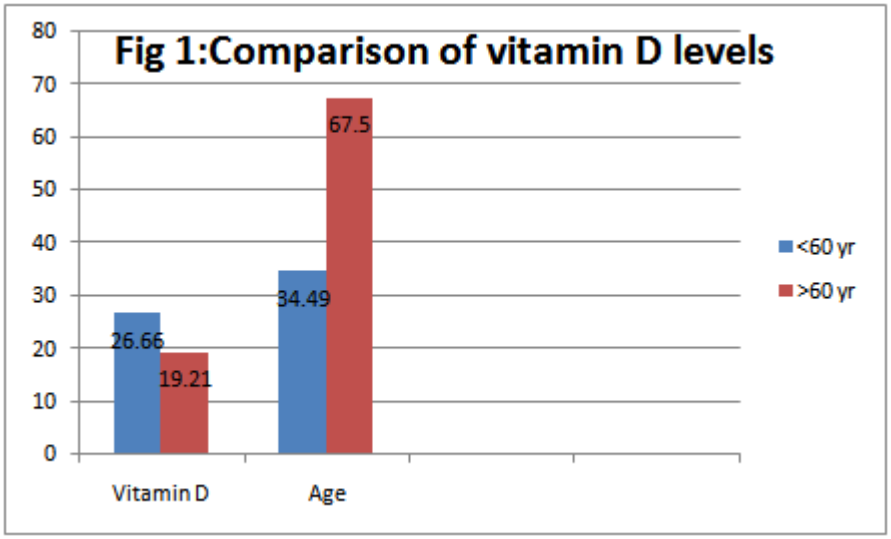
Table 1: Comparison of Vitamin D in elderly compared to young adults

	<60 (n=88)	>60 (n=73)	P value
Vitamin D (ng/ml)	26.66±19.41	19.21±11.445	0.003*
Age (yr)	34.49±11.84	67.5±6.37	0.001**

*Highly significant

**Very highly significant

n- number of subjects



Linear regression analysis showed a a significant positive association between age and vit D levels (R = 0.212 , R2= 0.045 , P=0.007)

No significant gender differences were observed in vitamin D levels.

Table 2: Gender differences in Vitamin D levels

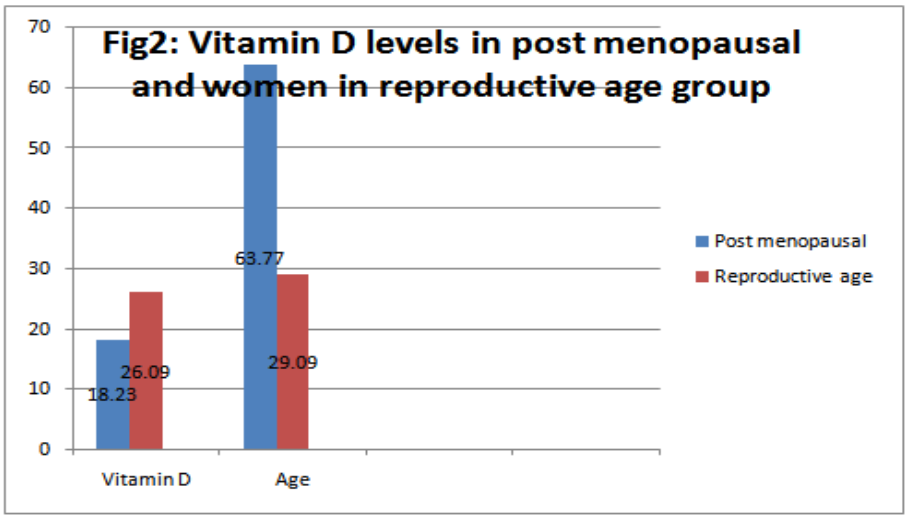
	Females (n=99)	Males (n=60)	P value
Vitamin D (ng/ml)	22.13±16.17	23.43±15.79	0.590
Age (yr)	46.44±19.61	54.23±17.55	0.011

* significant

Table 3: Comparison of vitamin D levels in Post menopausal Vs Reproductive age group

	Postmenopausal (n=49)	Reproductive age (n= 50)	P value
Vitamin D (ng/ml)	18.23±11.09	26.09±19.40	0.021*
Age (yr)	63.77±10.26	29.09±19.4	0.019*

* significant



Linear regression analysis showed a significant positive association between age and vitamin D levels in females (R = 0.236 R2= 0.056 P=0.019).

III. Discussion

A significant decline (27.9%) was observed in vitamin D levels in elderly patients as compared to young adults. A highly significant correlation was observed between age and vitamin D levels.

Low vitamin D levels observed in elderly could be attributed to the following factors; decline in calcium absorption, intestinal resistance of calcium absorption to circulating 1,25(OH)2D , decreased vitamin D resistance, decreased renal production of 1,25(OH)2D due to age related changes in kidney , decreased skin production of vitamin D and substrate deficiency of the vitamin.

Malabsorption of calcium occurs due to aging , leading to negative calcium balance and secondary hyperparathyroidism (2,3).Even thought there are many dietary factors that influence calcium absorption, the main regulator is vitamin D receptor (VDR) and synthesizing genes and proteins involved in calcium transport (5). Deletion of the VDR results in malabsorption of calcium(6). An intestinal resistance to endogenous circulating 1,25(OH)2D has also been reported in geriatric patients(11,12). A decline in intestinal vitamin D receptors may also contribute to lowered vitamin D levels in elderly (13). As renal function declines with age, there is a decrease in the activity of the renal enzyme 1α hydroxylase that converts 25OHD into 1,25(OH)2D. Aging reduces vitamin D production in skin. There is a decrease in the concentration of 7dehydrocholesterol in the epidermis in old compared with young individuals and a reduced response to UV light, resulting in a 50% decrease in the formation of previtamin D3(14).

All age-related changes in vitamin D metabolism are magnified if there is concomitant vitamin D deficiency, because it limits the substrate supply for 25OHD and ultimately 1,25(OH)2D. Substrate deficiency is a common problem in the elderly and is important to recognize because it is preventable and treatable. There may be deficiency of vitamin D either from diet or from lack of sunlight, and the decrease in serum 25OHD further limits 1,25(OH)2D production, especially when there is also renal dysfunction.

It has been reported that the dermal capacity to produce the vitamin in persons aged 65 years has been about 25% of that in persons aged 20–30 years exposed to the same amount of sunlight (15,16). This seems to be related to the reduction in the concentration of skin 7-dehydrocholesterol. Other indirect factors that reduce exposure to sunlight in older adults include the wearing of more concealing clothing, an increased use of sunscreen lotion, and reduced sun exposure, arising from less physical activity and time outdoors (17,18).

There was no significant gender difference was observed in vitamin D levels in our study. The reason could be that their age was not matched.

A significant lowering of vitamin D levels were observed in postmenopausal women compared to the women in reproductive age group.

The most commonly reported factors associated with inadequate vitamin D level were low sun exposure, low dietary vitamin D intake (including supplements), and older age. Lack of sun exposure from staying indoors, combined with the biological consequences of ageing, may contribute to the higher prevalence of vitamin D inadequacy in the elderly women.

A study by Gaugris et al reported a prevalence of inadequate vitamin D levels appears to be high in post-menopausal women, especially in those with osteoporosis and history of fracture(19).

Very high prevalence of vitamin D deficiency has been demonstrated in a large cohort of Romanian postmenopausal women with osteoporosis (20).

Capitina et al reported a Low vitamin D status in postmenopausal women. The author also opined that Vitamin D supplementation is indicated in postmenopausal women, especially in those at high risk of fracture. It also mentions that even though vitamin D supplementation is offered, the compliance is low, possibly even lower in subjects without osteoporosis or fragility fractures(21).

IV. Conclusion

Geriatric population had a low vitamin D levels compared to younger population.Lower serum 25(OH)D level may be associated with an increased fracture rate and increased rate of bone loss. This study suggests supplementation of elderly people with vitamin D may be beneficial .

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