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Relationship of vitamin D, BMI and BMD in age and gender linked population

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ABSTRACT

Background: Vitamin D insufficiency prevalence has been related to low bone mineral density (BMD). However, controversial results have been reported for the relationship between serum 25-hydroxyvitamin D [25(OH)D] levels and BMD. This study was done to investigate whether serum 25(OH)D levels were associated with BMD in different age group and sex link population.
Methods: This study involved, aged 40-70 yr, who is consecutively selected from KPCMCH, BMD camp. BMD was measured at the lumbar spine and femoral neck. The correlation between serum 25(OH)D levels and BMD was investigated.
Results: Vitamin D levels for healthy and patients individuals at hospital. The age of 40 healthy subjects ranged from 40 to 70 years with the average of 55.30±10.30 years and body mass index (BMI) ranged from 18 to 37 kg/m^2, with the of average of 28.90±5.20 kg/m^2. Comparison between healthy and patients based on BMI and vitamin D level for the overweight BMI healthy individuals was 29.78±9.40 ng/ml, and that of hyperlipidemic patients was 24.47±8.78 ng/ml.
Conclusions: In this study, there is significant different between healthy and patients group in vitamin D_3level.BMD significantly decreased in patients group more elderly.

Keywords: Vitamin D, Gender, BMI, BMD

INTRODUCTION

Vitamin D is considered essential for bone health. In some studies, vitamin D insufficiency has been reported to be associated with low bone mineral density (BMD) and increased bone loss.[1,2] However, the results reported so far have been controversial.[3,4] Now obesity is another rapidly growing health problem in most developed countries.[2] During the last decade, the prevalence of obesity (body mass index (BMI) ≥30) increased dramatically. Vitamin D low levels negatively affect bone mineralization causing rickets in children and osteomalacia in adults.[3,5] In addition, vitamin D insufficiency is associated with other diseases; chronic kidney disease (CKD) gives rise to secondary hyperparathyroidism (SHPT) which can lead to loss of bone density and elevated rates of fracture in renal patients, common cancers, autoimmune disorders, multiple sclerosis, cardiovascular disease, lung function, and asthma.[6-12]

METHODS

Study population

In this cross-sectional study 100 subject have been enrolled which was conducted in March 2016 in BMD camp of KPCMCH. Out of hundred subject: 40 subjects were apparently healthy and 60 subjects were selected as a patients after taking the history of inclusion criteria included: Multiple joint pain for prolong period in adult, Low back pain with kyphotic deformity in elderly age group, young patients with pain in long bones of lower limb, history of fracture with insignificant trauma.

Serum collection and analysis

Blood samples (6 ml) were collected from each subject in the morning after an overnight fast. The blood was centrifuged for 10 min at 1000 rpm to obtain serum. The serum was placed in Eppendorf tubes and stored at -80°C until used.

Measurement of vitamin D

Quantitative colorimetric immunoenzymatic determination of 25(OH) vitamin D concentrations in human plasma level was developed by using vitamin D ELISA kit (Diametra, Milano, Italy). The kit is a competitive solid phase enzyme-linked immunosorbent assay (ELISA). Samples were analyzed according to the manufacturer guidelines.

Vitamin D levels were classified into 3 major groups as follows:[13,14]

1) Sufficient (>30 ng/ml);
2) Insufficient (20–30 ng/ml);
3) Deficient (<20 ng/mL).

BMI measurements

Women were divided into six and men into five BMI groups: i) BMI <20– underweight (only for women); ii) BMI 20-24.9– normal weight; iii) BMI 25-29.9– overweight; iv) BMI 30-34.9– obesity, degree I; v) BMI 35-39.9 –obesity, degree II; vi) BMI ≥40– super obese, obesity degree III.[15]

Bone mineral density examination

BMD was determined using dual energy x-ray absorptiometry (DEXA). Both spine region including lumbar vertebrae 1-4 and femoral neck area l BMD were obtained. To eliminate operator differences, all women were tested by the same operator during the study

Statistical methods

Data from 100 subjects were expressed as mean±SD and statistically analyzed using SPSS v. Linear regression analysis was performed to assess correlations between BMI, serum 25(OH)D3 and 1,25(OH)2D3 levels, age and gender. P values <0.05 were considered as indicating statistical significance.

RESULTS

Table 1 summarizes the age and the body mass index (BMI) of the first group subjects (100 subjects (40–70 years) vitamin D levels for healthy and patients individuals at hospital.

Table 1: Demographics data (age and body mass index) of all participants (n=100).

Parameter	Healthy individuals (n=40) Mean±SD	Patients (n=60) Mean±SD
Total		
Age (years)	55.30±10.30	55.88±9.38
BMI (kg/m^2)	28.90±5.20	28.82±5.49
Males		
Age (years)	55.90±10.24	54.80±9.86
BMI (kg/m^2)	29.10±5.21	27.98±4.90
Females		
Age (years)	54.10±10.50	58.20±10.04
BMI (kg/m^2)	28.40±4.50	28.74±5.21

Table 2: Mean value of vitamin D levels in ng/ml for 40 to 70 years of age in healthy and patients at hospital.

Category	Healthy vitamin D (ng/ml)	Patient vitamin D (ng/ml)	P value
Total	30.78±10.50 (n=40)	25.98±8.83 (n=60)	<0.0001
Total males	33.18±11.22 (n=16)	25.04±8.02 (n=45)	<0.0001
Total females	29.55±9.98 (n=24)	23.54±7.74 (n=15)	0.0225
Normal BMI weight	31.30±9.42 (n=6)	27.67±10.10 (n=14)	0.2209
Overweight	29.78±9.40 (n=33)	24.47±8.78 (n=21)	0.0087
Obese	26.51±6.90 (n=14)	20.76±6.21 (n=25)	0.0002
40-50 years	37.42±9.08 (n=20)	26.88±9.88 (n=30)	<0.0001
51-60 years	31.07±4.65 (n=12)	26.35±6.34 (n=18)	0.0027
Over 60 years	22.52±3.56 (n=08)	17.97±6.98 (n=12)	0.0126

Significant (p<0.050).

Subjects: The age of 40 healthy subjects ranged from 40 to 70 years with the average of 55.30±10.30 years and body mass index (BMI) ranged from 18 to 37 kg/m^2, with the of average of 28.90±5.20 kg/m^2 (Table 1).

Besides, the age of 60 patients ranged from 40 to 70 years, with the average of 55.89±9.39 years, and body mass index (BMI) ranged from 17 to 37 kg/m^2, with the average of 28.82±4.94 kg/m^2 (Table 1). Further classification is also found in Table 1.

Furthermore, Table 2 showed the differences in vitamin D levels between the healthy and patient's subjects. A significant difference ($p<0.050$) was detected between healthy males (25.04±08.02 ng/ml) and females (23.55±7.74 ng/ml).

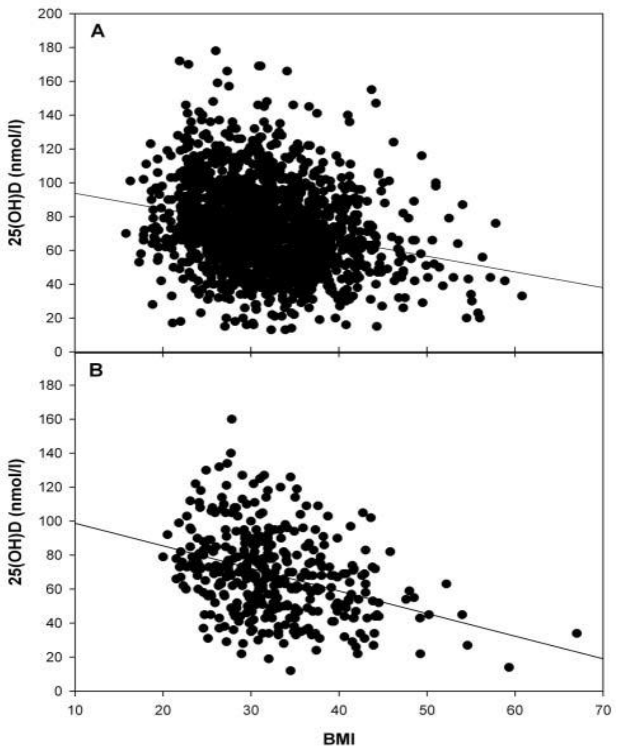

Figure 1: Serum 25(OH)D3 concentrations (nmol/l) in women (A) and men (B) versus BMI.[16]

Comparison between healthy and patients based on BMI was done and vitamin D mean level for the normal BMI healthy individuals was 31.30±9.42 ng/mL, while that of patients was 27.67±10.10 ng/ml. Also, vitamin D level for the overweight BMI healthy individuals was 29.78±9.40 ng/ml, and that of hyperlipidemic patients was 24.47±8.78 ng/ml (Table 2).

DISCUSSION

In our study we found that there is a linear relationship between vitamin D, BMI and BMD. Patients with increased BMI having excess amount of body fat, which is a very good reserver of fat soluble vitamine D. So obese patients have a very high reserve and low blood concentration of vitamin D as release of vitamin D is extremely slow from body fat. So BMI adversely affects vitamin D concentration in blood.[17-20]

Vitamin D concentration also depends on gender, nationality, physical activity, age, lifestyle, taking particular drugs and food habits.[21–24] Low vitamin D concentration in pediatric age group results in ricket (before epiphyseal fusion) and in adults it results in osteomalacia (after epiphyseal fusion). Therefore low vitamin d children results in bone pain, skeletal immaturity and various deformities, less chance of fracture healing due to low bone matrix formation.

BMD mainly depends on age, activity level, and menopause. Decrease in BMD results in kyphotic deformity of spine due to weakness of weight bearing dorsal spine. It also leads to pain, decrease in activity level and again it decrease BMD.[25,26]

Obesity and increase in body weight lead to more deformity and pain in low BMD patients. So obesity is responsible for low vitamin D3 and increase morbidities in senile population.

CONCLUSION

In this study there is significant different between healthy and patients group in vitamin D_3 level. BMD significantly decreased in patients group more elderly.

There is significant correlation between vitamin D3 level and BMD at hip and spine. Male gender, BMI and age are significant predictor of BMD. Patients with higher BMI have significantly lower BMD. So, vitamin D_3 level is adversely related with BMI. It suggests that Obesity adversely affects bone health and prone to bone fragility, bone pain and fractures.

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Ethical approval: The study was approved by the institutional ethics committee

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