

ASSOCIATION BETWEEN DECREASE IN SERUM VITAMIN D LEVEL AND INCREASE IN BODY MASS INDEX

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ABSTRACT

Background: Levels of vitamin D in the population have come under increasing examination; however there are only a few studies in Saudi Arabia which measure levels in the general population. The objective of the study was to measure the association between decrease in level of vitamin D and increase in BMI in males and females of Saudi population.

Material & Methods: A cross sectional study of 94 participants with age range 16-75 years in a group of Saudi Arabian people was conducted. Duration of study was six months (June to November 2014). Both male and female were comprised into four groups, group A with an age range 15-30 years, group B with age range of 31-45 years, group C with age range of 46-61 years and group D with age range of 62-75 years. Individuals who visited with complaints of musculo skeletal pain, backache and easy fatigability were included in the study. Their body weight and height were measured for BMI. Serum levels of 25-hydroxy vitamin D [25(OH)D] in relation to demographic characteristics (age, sex) and selected health risk factors (physical activity, body mass index) were examined.

Results: Overall, the mean level of serum 25(OH)D was <20 IU in 70% female and 30% male which is recognized as vitamin D deficiency. A highly significant positive correlation ($P < 0.001$) was observed between decrease in vitamin D and increase in BMI with r value 0.812 and 0.963 in male and female respectively.

Conclusion: Vitamin D deficiency is strongly associated in young obese people of both genders.

KEY WORDS: Vitamin D; Obesity; Body Mass Index.

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INTRODUCTION

Vitamin D deficiency occurs worldwide. Factors like low sunlight exposure, age-related reduction in cutaneous synthesis, high Body Mass Index (BMI) and foods low in vitamin D increase the likelihood of vitamin D deficiency^{1,2} Obesity is one of the major factors of vitamin D deficiency although its exact mechanism is not known.³ It is suggested that obese individuals may avert sun light exposure, that

is important for the cutaneous synthesis of vitamin D.⁴ Instead, it is also proposed that increased formation of vitamin D metabolite 1,25-dihydroxy vitamin D may have negative feedback on the hepatic synthesis of vitamin D.⁵ It is also found that in obesity there is increased metabolic clearance of vitamin D especially in women, may be because of increased uptake by adipose tissue.⁶ Prevalence of obesity was higher among women as compared to men (33.5% vs 24.1%). Among women, obesity was associated with marital status, education and hypertension whereas for men obesity was linked with marital status, diet, physical activity, diagnosis of diabetes, hypercholesterolemia and hypertension.⁷ Distinguishing vitamin D deficiency in children may be significant for their skeletal and cardiovascular wellbeing. Fractures, Blount disease, slipped capital femoral epiphysis and impaired glucose homeostasis are more common in obese people

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and may be associated with vitamin D deficiency.^{8,9} Insufficiency of vitamin D is reported in approximately 36% elderly patients and also among patients with osteoporosis. The prevalence of vitamin D deficiency that is <50 nmol/L was 87.8% and insufficiency being ≥ 50 -75 nmol/L was 9.7%, respectively.¹⁰

According to World Health Organization sponsored MONICA Project 30% of the Arab World population is overweight or obese, including both adolescents and adults.¹¹ The reason may be lack of physical activity due to the luxury life including accessibility of housemaids, cars and sophisticated household appliances.¹² Cutoffs Values have also been described as deficiency being <25 nmol/L 25(OH)D, insufficiency as 25-50 nmol/L, whereas sufficiency >50 nmol/L.¹³ Vitamin D has a vital role in the synthesis of bone tissue and low levels of vitamin D may lead to rickets, osteoporosis, increased susceptibility to fractures, tooth loss and osteomalacia.¹⁴⁻¹⁷ Deficiency of Vitamin D is also linked with a swarm of chronic conditions, including type 1 diabetes, hypertension and multiple sclerosis.¹ However, these studies are usually cross sectional and carried out in different conditions making assessments difficult. Inadequate vitamin D status (<50 nmol/L) is an increasingly important health issue in Saudi Arabia as it is essential for skeletal health in every age group. Besides adults and elderly people identification of deficiency of vitamin D is also important in children as well as adolescents due to occurrence of peak bone-mass accrual.

The objective of the study was to measure the association between decrease in level of vitamin D and increase in BMI in males and females of Saudi population.

MATERIAL AND METHODS

This cross sectional study was conducted at department of King Abdul Aziz Specialist Hospital, Al-Jouf, Kingdom of Saudi Arabia from June to November 2014. Sample size was 94 selected through convenient sampling technique. Inclusion criteria was individuals of both sexes having complaints of bone pain, backache or easy fatigability. Exclusion criteria was individuals with renal disease or bone disorders. Demographic variables were gender and age having attributes of 15-30, 31-45, 46-61 & 62-75 years. Research variables were BMI with 4 attributes of healthy weight, over weight, obese and severely obese. Vitamin D having 3 attributes of normal (30-75 IU), vitamin D insufficiency (20-29 IU) & vitamin D deficiency (<20 IU). Measurements of vitamin D was done by using the DiaSorin radioimmunoassay kit (Stillwater, MN). Age, BMI and vitamin D being numeric were expressed as means \pm SD, whereas gender and age group being categorical were analyzed through frequency and percentages. Linear relations between

serum levels of vitamin D and BMI were computed by using Pearson correlation coefficient. Results were considered significant if p values was <0.05 . A structured performa was used to record data. Data was analyzed by SPSS 20.0.

RESULTS

Out of 94 subjects 30% were males and 70% were females. Distribution of the sample by age groups, BMI and vitamin D levels is given in table-1. A highly significant positive correlation ($P<0.001$) was observed between decrease in vitamin D and increase in BMI with r value 0.812 and 0.963 in male and female respectively (Fig 1 and 2).

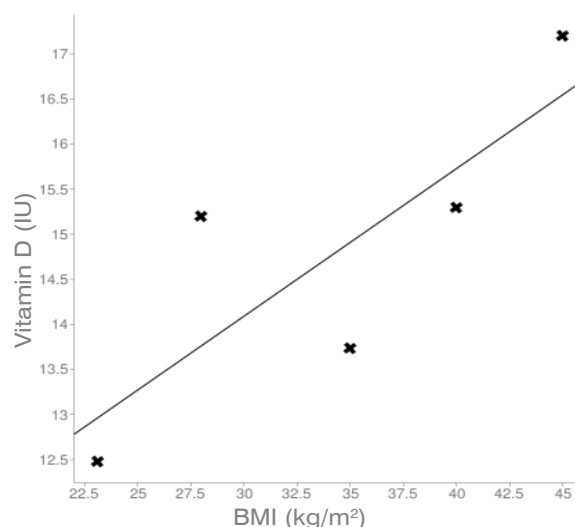


Fig 1: Significant positive correlation of decrease in level of vitamin D with increase in BMI in a group of men ($r=0.812$).

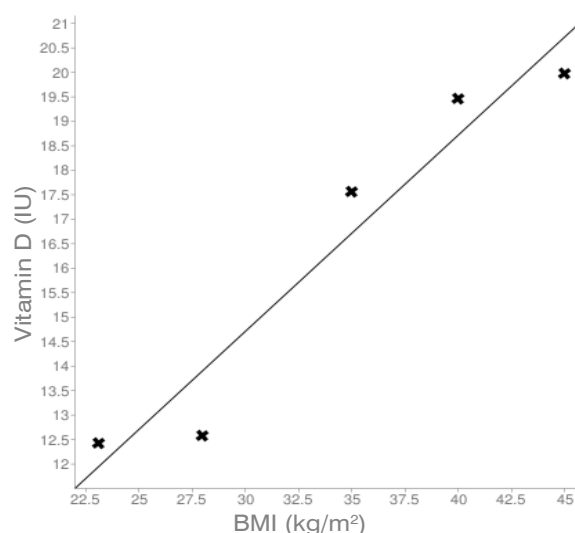


Fig 1: Significant positive correlation of decrease in level of vitamin D with increase in BMI in a group of women ($r=0.963$).

Table 1: Association of Vitamin D deficiency and BMI in subjects of different age groups.

Subjects	Frequency	Age range (years)	BMI range (Kg/m ²)	Vitamin D (IU)
Male (30%)	26%	15-30	22-25	12.48 ±5.83
	26%	31-45	26-30	15.2 ±7.26
	26%	46-61	31-39	13.73 ±4.1
	22%	62-75	>40	15.29 ±7.35
Female (70%)	49.2%	15-30	22-25	12.42 ±5.82
	22%	31-45	26-30	12.57 ±6.37
	17.4%	46-61	31-39	17.55 ±5.22
	11.4%	62-75	>40	19.47 ±5.97**

**p<0.001 = Highly significant difference

DISCUSSION

Although the role of vitamin D for bone health is well established recent studies also propose the protective role of vitamin D against non-communicable diseases.¹⁸

Present study showed that females (70%) were more prone to musculoskeletal pain and easy fatigability as compared to males (30%). However a study found the prevalence of vitamin D deficiency (<50 nmol/l) was 22% in men and 39% in women. A study reported that the prevalence of deficiency of vitamin D increasing with age, was more in females in the obese subjects and those who have sedentary life style.¹⁹

We found that both male and female with age 16-75 years have severe vitamin D (<20 IU) deficiency. A highly significant correlation ($p < 0.001$) was observed between decreased vitamin D and increased BMI with r value 0.812 and 0.963 in male and female respectively.

In males the range of vitamin D was 12-15 IU in all age groups. However in females the vitamin D deficiency was more frequent (49.2%) in subjects aged 15-30 years followed by 22% in subjects aged 31-45 years. However a study found that the prevalence of deficiency of vitamin D was 30% in females of 50 to 60 years of age and greater than 80% in females after the age of 80 years.²⁰ According to a study deficiency of vitamin D (<20 IU) is associated with osteomalacia.^{21,14}

The frequency of vitamin D deficiency was decreased with increasing age. According to a study prevalence of vitamin D deficiency in subjects aged 65 years or > 65 was 13% in females and 8% in males.²² Our study is in contrast with a study who reported that cutaneous synthesis of vitamin D and its stores decrease with age. Achlorhydria is common in older subjects and it may limit calcium absorption.²³ A study carried out on people living in Saudi Arabia reported that vitamin D deficiency affects bone mass density as well as bone turnover

markers among Saudi Arabian males and is largely attributed to sedentary lifestyle, minimal exposure to sunlight, older age and obesity.¹⁰

According to recommended normal values of vitamin D (30-75 IU) is a highly significant difference was observed when compared with values of vitamin D of male and females. According to a study serum level of vitamin D should be >32 IU to improve calcium absorption.²⁴ It is suggested that proper vitamin D concentration may also be significant for providing the enzyme renal 1-alpha-hydroxylase which is necessary for the production of 1,25-dihydroxy vitamin D₃.²⁵ Deficiency of vitamin D may initiate and aggravate osteoporosis among adults and causes bone aches and it is the most important factor in predicting the risk of fractures of the neck of femur.²⁶

Present study also observed that there is a significant direct relationship of low levels of vitamin D with high values of BMI in all age groups in both sexes. According to another study high values of BMI were also associated with low vitamin D levels in obese males as well as females. Study reported that obese people may have sedentary life style, however this inverse relationship has also been attributed to cholecalciferol, the precursor of vitamin D present in adipose tissue and may be responsible for low body vitamin D levels as conversion to 25(OH)D does not occur.²⁷ Another study reported that obesity did not affect the capability of the skin to synthesize vitamin D₃, but may have affected the release of vitamin D₃ from skin into the circulation.²⁸

Present study was carried out in summer season and we agreed with a study that plentiful existence of sunlight may not prevent the deficiency of vitamin D.²⁰ However according to a study the most significant predictors of reduced 25(OH)D in both sexes were winter and spring season.²⁹

Diet & supplements and maintenance of normal body weight are chief modifiable factors for increasing vitamin D level and thus potentially influencing

vulnerability to common chronic diseases. Present study was in agreement with a study who found that low vitamin D status was considerably associated with sedentary lifestyle and obesity (BMI ≥ 30).³⁰

CONCLUSION

Vitamin D deficiency is strongly associated in young obese people of both genders.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

None declared.

AUTHORS' CONTRIBUTION

Conception and Design:	SR, RK, UFA
Data collection, analysis & interpretation:	SR, RK, UFA, SMQR, BH, MAA,
Manuscript writing:	SR, RK, UFA, SMQR, BH, MAA