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25 –HYDROXY VITAMIN D LEVELS IN HEALTHY FEMALE MEDICAL STUDENTS – ASSOCIATION WITH DIETARY INTAKE, ANTHROPOMETRIC INDICES AND SUN EXPOSURE – A PILOT STUDY

Physiology

Dr Yamini Lavanya* M.D Associate Professor, Department of Physiology, Dr.Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation , Chinnavutapalli -521286 AP. *Corresponding Author

A. Ganesh (MBBS) Dr.Pinnamaneni Siddhartha Institute of Medical Sciences and Research Foundation , Chinnavutapalli -521286 AP.

ABSTRACT

AIMS AND OBJECTIVES: Poor maternal vitamin D status during pregnancy was associated with unfavourable outcomes for the mother. Young adults are at risk for vitamin D deficiency, no specific recommendations exist regarding evaluation of their vitamin D status. The purpose of the study is to examine vitamin D status in a group of fair-skinned women of childbearing age and to determine the impact of dietary vitamin D intake, vitamin D supplement use, body mass index (BMI), and sun exposure.

METHODS: A Cross sectional study was done in 30 Female under graduate students. 25(OH) Vitamin D was estimated using fully auto chemiluminiscence immunoassay (CLIA) analyzer MAGLUMI.

RESULTS: The study found that 93.3% of study population had vitamin D level less than 10ng/ml.

CONCLUSION: Vitamin D deficiency was highly prevalent even among medical students included in this study despite of adequate availability of sunlight.

KEYWORDS

Vitamin D, sun exposure, Anthropometric indices

INTRODUCTION:

The discovery of vitamin D receptors throughout the human body generated interest in the non-skeletal benefits of vitamin D. [1] Poor maternal vitamin D status during pregnancy has been associated with unfavourable outcomes for the mother such as delivery by caesarean section [2], preeclampsia [3] and gestational diabetes [4], as well as for the child. Outcomes for the child include low bone mineral content [5] and being small for gestational age. [6] Thus, adequate vitamin D status in women of childbearing age may be important. The main dietary sources of vitamin D include meat, dairy products and fatty fish. Vitamin D can also be derived from supplements or be synthesized in the skin by exposure to ultraviolet (UV) light, primarily UV-B.

The increasing measurement of serum 25-hydroxyvitamin D in older people arises from an increasing awareness of the prevalence of hypovitaminosis D and the role of vitamin D in both the prevention and management of osteoporosis.[7] However, the prevalence of hypovitaminosis D and its impact on health is less certain in adults under 50 years of age.

Healthy young adults may develop vitamin D deficiency for several reasons. First, the vitamin D intake of young adults is often below the recommended intake of 200 IU/day.[8] Second, young adults today spend less time outside than young adults one decade ago.[9,10,11] Third, the increasing use of sunscreen to reduce skin damage or cancer may decrease or eliminate cutaneous vitamin D synthesis.[10,12,13] Finally, many young adults drink carbonated beverages in place of milk, thereby decreasing the intake of both Ca and vitamin D and potentially increasing the risk of fracture. [14]

Despite mounting evidence that young adults are at risk for vitamin D deficiency, no specific recommendations exist regarding evaluation of their vitamin D status. Such lack of guidelines may result from limited information on either the impact of vitamin D on the development of peak bone mass [15-17] or the long-term safety of increasing serum 25(OH)D levels in young adults.

The knowledge that lower vitamin D status has been associated with unfavourable pregnancy outcomes emphasizes the need to investigate the vitamin D status and its determinants in women of childbearing age .Understanding the determinants of vitamin D status is necessary to increase the possibilities of improving vitamin D status when needed. This warrants an examination of the impact of the individual factors influencing vitamin D status, particularly the modifiable factors relating to lifestyle and behaviour. The purpose of the present study is to examine vitamin D status in a group of fair-skinned women of childbearing age and to determine the impact of dietary vitamin D intake, vitamin D supplement use, body mass index (BMI), and sun exposure.

AIMS & OBJECTIVES:

1. To identifies the status of vitamin D levels in young adults.
2. To correlate vitamin D status with BMI, food intake and sun exposure

MATERIALS AND METHODS:

TYPE OF STUDY: A Cross sectional study. STUDY GROUP: Female under graduates (1-9) semesters of our college. SAMPLE SIZE: 30 SELECTION CRITERIA: INCLUSION CRITERIA- Healthy, fair-skinned, female, nulliparous undergraduate medical students, age - 18 to 25 years. EXCLUSION CRITERIA: Male undergraduates, history of acute or chronic liver or renal disease or endocrine or autoimmune diseases, positive family history of inherited diseases of calcium or vitamin D metabolism, Skin diseases, eating disorders, Malabsorption syndromes, hypertension, heart disease, pregnancy, diabetes, epilepsy, use of oral contraceptives/HRT/anabolic/systemic steroids, bisphosphonates , insulin.

STUDY DESIGN: Participants were recruited from our educational institution. Regional Ethics Committee approval was taken for all procedures involving human Subjects. Written informed consent was obtained from all the study participants. Information was obtained from participants using questionnaire which explored Student's knowledge of sources of vitamin D and its relation to risk of osteoporosis, cardiovascular disease, cancer and diabetes. The questionnaire also addressed the frequency, duration and contributing factors for sun exposure, lifestyle, Intake of dairy products and other nutritional factors. The questionnaire covered relevant medical history and symptoms related to the musculo -skeletal system. Vitamin supplementation and use of other medication details was taken.

Weight in Kilogram, height in meters was recorded and Body Mass Index was calculated using Quetelet formula (Wt in Kg/Ht in m^2). BMI was grouped into: underweight - BMI < 18 kg/m^2, normal weight -18.5 kg/m^2 ≤ BMI< 25 kg/m^2, overweight -25≤ kg/m^2 BMI < 30 kg/m^2, obese -BMI ≥ 30 kg/m^2.

Blood sample was collected; serum was stored at −20 °C until analysis, assessed for 25(OH) Vitamin D using fully auto chemiluminiscence immunoassay (CLIA) analyzer MAGLUMI. The chemiluminescence assay is an accurate, rapid and precise method for vitamin D measurement, correlating well with traditional radioimmunoassay but overestimating levels by 3.9ng/ml compared with High performance liquid chromatography(HPLC).[18-20] Based on Serum-25[OH] vitamin D levels, subjects were grouped into three categories: value

less than 20ng/ml-deficiency, (21-29ng/ml) insufficiency and (≥30 ng/ml)sufficiency .[21-22] The inter-assay coefficient of variation was less than 10 %. The lower detection limit was 3 ng/mL, and the upper detection level was 88 ng/mL.

STATISTICALANALYSIS:
All the data was analysed using MS-Excel 2010 and SPSS trial version 22. All the descriptive data, quantitative variables were expressed as mean and standard deviation; qualitative variables were expressed as percentages. Multivariate ANOVA test was used for comparing the variables. For all the tests, probability value was assessed as P≤ 0.05 which was considered significant association.

RESULTS:
The mean age of the study population was 19.93 ± 0.691 years .The mean vitamin D level in these women was 5.5623±2.7553 ng/ml, While the range was 3.0 ng/ml to 13.11 ng/ml .The mean weight of the study population was 61.0667 ± 12.95132 kg. The mean BMI was 22.5876 ± 4.75636 kg/m ^{2} . Based on BMI values 56.7%(n=17) of study population were normal weight with vitamin D levels of 6.27 ± 3.20 ng/ml, 20%(n=6) were underweight with vitamin D levels of 3.8± 0.99 ng/ml.

The study found that 93.3% (n=28) of study population had vitamin D level less than 10ng/ml which was consistent with deficiency of vitamin D as per study design. The study found that the mean vitamin D level in day scholars was 5.88 ± 2.59 ng/ml versus 5.24 ± 2.95 ng/ml in hostellers.

93.3% of the study population who were non vegetarians by diet preferences had mean vitamin D levels of 5.69 ± 2.79 ng/ml. As fish is good source of vitamin D, based on frequency of consumption of fish 53% consumed <once /week, although vitamin D levels were better in population who do not consume fish with 6.16± 3.26 ng /ml. Based on consumption of fast foods 46.7% of study population consumed 2-3 times a week, highest level of 8.16± 5.56 ng/ml was found in 6.7% of study population who consumed fast foods for 4-6 times per week. 43% of study population consumed carbonated drinks once/week although vitamin D levels were better in those who consumed once/month.76.7% of study population consumed milk once daily with vitamin D value of 5.78±3ng/ml which is better than those who consumed twice/less often .16.7% (n=5) of study population consumed vitamin D supplements although the mean level of vitamin D estimated was lesser in them than those who does not consume any supplements.

56.7% of study group did not use sunscreen but vitamin D levels are better in those who use sunscreens .Based on duration of exposure to sun 40% were exposed >30 minutes/day although levels were good in those who were exposed for just 5-15 minutes/day with mean SD value of 6.25± 3.85ng/ml. Levels were better in those who were exposed to sun between 10-3 pm who constitute 50% of study group with mean vitamin D levels of 5.69±3.23ng/ml. Mean vitamin D of 5.99±2.91 ng/ml was observed in those who received suntan in the past 6 months which is better than those who doesn't ,who constitute 76% of participants. Multivariate ANOVA found no statistically significant association between the variables and vitamin D.

DISCUSSION:
Vitamin D plays an important role in diverse physiological functions in addition to its role in bone homeostasis. Epidemiological studies revealed an association between vitamin D levels and a wide range of chronic diseases that include cardiovascular diseases, metabolic diseases as diabetes mellitus, autoimmune diseases as multiple sclerosis ,rheumatoid arthritis, neoplastic diseases as colon cancer and breast cancer in addition to well known musculoskeletal complications.[23] Vitamin D deficiency continues to be an unrecognized epidemic in many populations around the world.[24] Abdul Mobsen Hal in his study involving 198 medical students in Saudi Arabia found 100% of study subjects were having vitamin D deficiency or insufficiency.[25] Our study involving 30 nulliparous medical students with mean age of 19.93 years found 93% of these subjects had vitamin D levels less than 10ng/dl, which we had defined as vitamin D deficiency during commencement of study.

The lowest mean vitamin D level of 3.8ng/dl observed in 20% subjects with BMI < 18.5 kg/m ^{2} could be attributed to generalised malnourishment leading to underweight. Vitamin D deficiency has been shown to be responsible for alterations in the immune response leading to an increased risk of infection. It has been postulated that these infections may predispose to vitamin D deficiency especially increased rates of diarrhoea with vomiting and earache/discharge with fever. Celiac disease, associated with abdominal pain, diarrhoea and weight loss, osteopenia or osteoporosis and osteomalacia have been found in vitamin D deficiency, hence malnutrition and vitamin D deficiency are both in a vicious cycle. [26] As stated by Nabeta et al in their study, the mean daily exposure to sunshine among the non-malnourished children was 5.8 h compared to 4.5 h among the malnourished children. This could probably explain the difference in the vitamin D deficiency prevalence levels between these groups. Factors that include the illnesses among the malnourished children may play a role in these sick children spending time indoors. [27]

Most of our study subjects were lean, presented with normal BMI. The overweight and obese population in study group had lower vitamin D levels than the subjects with normal BMI .The higher mean of 6.27ng/dl observed in normal BMI population compared to overweight and obese population. These findings coincide with Holick et al studies that showed an inverse relationship between obesity indicators- BMI and waist circumference, and vitamin D deficiency. This was explained due to the fact that vitamin D is a fat-soluble hormone and normally stored in fat tissue, and because the obese subjects had more surface area, vitamin D would penetrate more in the larger body mass of the fat tissue of the obese subjects. [28] But the correlation between vitamin D deficiency and obesity indicators like BMI were not significant, it could be due to relatively low sample size. Ming Zhou et al in their study stated that university students were required to spend time on studying, they increasingly spend most of their time on screen-based entertainment activities leading to the indoor dwelling and sedentary lifestyle .Lack of time, living in a hostel, skipping important meals like breakfast and lunch, irregular meal timings and unhealthy food choices are likely to be involved in problematic eating behaviours.[29] The day scholar students have marginally higher mean vitamin D levels compared to hostel inmates in our study owing to higher day light exposure involved during their travel to and from house to college and better nutrition and care they received compared to hostel inmates.

The subjects on non vegetarian diet in study population had higher mean vitamin D level of 5.69 ng/dl compare to vegetarian subjects emphasising the fact that diet constitutes an important source of vitamin D in this area. But there was no statistical difference. This concurs with the conclusion of Jacqualine chan et al study [30] where they concluded that 25(OH) D concentrations are not associated with vegetarian status because vitamin D from dietary sources, both naturally occurring and fortified, is limited. Other factors, such as vitamin D supplementation, degree of skin pigmentation, and amount and intensity of sun exposure, have greater effect on 25(OH) D than does diet.

Subjects consuming fast foods had higher levels of vitamin D compared to those not consuming fast foods implicating role of cheese and mayonnaise as a source of vitamin D in south India.16.7% of population who were taking multivitamin supplements still had lower mean serum vitamin D levels compared to 83.3% of the study group not taking them implicating that the normal multivitamin supplements available in India have less vitamin D.

76.7% of subjects who had suntan had a mean vitamin D of 5.99 ng/dl compared to 4.14 ng/dl in 23.3% of subjects who did not had suntan, reinforcing the fact that sun exposure is good source of vitamin D in south India. There was no statistically significant difference in serum vitamin D levels in individuals using and not using sun screens and our study confirms that. Average exposure of 5-15 minutes a day to sunlight has highest mean vitamin D levels in serum.76.7% of subjects who had suntan had a mean vitamin D of 5.99 ng/dl compared to 4.14 ng/dl in 23.3% of subjects who did not had suntan, reinforcing the fact that sun exposure is good source of vitamin D in south India.

Limitations of study:
The absence of statistically significant correlation in the parameters studied in the group reflects that we need to conduct the study in a larger group.

CONCLUSION:
Vitamin D deficiency was highly prevalent even among medical

students included in this study despite of adequate availability of sunlight. An urgent action has to be taken in order to prevent adverse consequences of low vitamin D in the young, otherwise healthy populations.

IMPLICATIONS:

Low vitamin D concentrations are present in a significant proportion of the population. Women with pigmented or covered skin, obesity and immobility are at a higher risk. Low vitamin D concentrations have been associated with a wide range of adverse maternal and offspring health outcomes in observational epidemiological studies. Poor vitamin D status during pregnancy may result in unfavourable outcomes for mother and child. Thus, educating regarding vitamin D status and ensuring adequate vitamin D status in young women of childbearing age may be important for the future health of mother and baby.

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