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Vitamin D Insufficiency in Women Inadequately Exposed to Sunlight: A Comparative Observational Study

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Abstract

Introduction: *Vitamin D is a catabolic product of cholesterol metabolism. Conversion of 7-dehydro-cholesterol to active vitamin D is largely dependent upon exposure to Ultraviolet B rays coming from sunlight. The individuals not exposed to adequate sunlight are prone for developing vitamin D deficiency conquest upon inadequate conversion of 7-dehydrocholesterol to provitamin D3 and Active Vitamin D. Vitamin D deficiency is one of the common problems in south East Asian women in child bearing age groups. This is not only detrimental for the women but also may cause intrauterine growth retardation, low birth weight and adverse pregnancy outcome. The common causes of vitamin D deficiency include increasing age, inadequate exposure to sunlight and chronic diseases. In south East Asian countries many females are not adequately exposed to sunlight moreover their nutrition also is deficient in vitamin D. We have conducted this study to know the vitamin D status of females not adequately exposed to sunlight due to reasons like housewives constantly remaining in home, dressing style, young girls using excessive sun screen and those belonging to high socioeconomic status who usually remain in air-conditioned environment mostly restricted to homes, offices or cars.*

Aims and Objectives: *To determine the frequency of vitamin D deficiency or insufficiency in women residing in twin Cities of Hyderabad and Secunderabad who are not adequately exposed to sunlight.*

Materials and Methods: *This was a case control study carried out in a tertiary care hospital situated in Hyderabad. 36 Women with no co-morbidities and having history of inadequate exposure to sunlight were enrolled in this study as cases. Control group comprised of women of similar age and physical characteristic who were determined, on the basis of detailed history, to have adequate exposure to sunlight. In both these groups detailed histories was taken with a view to exclude co-morbidities and know the status of sun exposure. Investigations like CBC, Sr Calcium and ALP were done in all the cases. The data was tabulated and analyzed using SPSS 16.0 version software.*

Results: *The mean weight and BMI were comparable in cases and controls. The mean weight of control group was 59.38 +/- 2.72 kg while in cases group the mean weight was 64.38 +/- 3.52 kg. While mean height in control and cases group was 5.35 +/- 0.047 and 5.178 +/- 0.035 feet respectively. Serum calcium in cases and control groups was 8.869 +/- 0.126 and 8.635 +/- 0.121 while ALP was 98.30 +/- 7.97 and 104.04 +/- 4.770 respectively. Finally 25 (OH) Vit D was found to be 96.27 +/- 8.96 in control group and 73.403 +/- 4.42 in*

cases group. The findings confirmed the presence of via D insufficiency in cases group i.e. women not exposed adequately to sunlight.

Conclusion: *Vitamin D insufficiency and deficiency is a common occurrence in south East Asian women of child bearing age group. This is not only detrimental for women but also may cause an adverse pregnancy outcome. We recommend that all women should adequately be exposed to sunlight and should intentionally expose themselves to sunlight and take food rich in calcium (Fish, egg yolk, non-veg food and milk.). Vitamin D supplementation in appropriate doses should be given to women with vitamin D insufficiency or deficiency.*

Keywords: *Vitamin D insufficiency, inadequate exposure to sunlight, Vitamin D supplementation.*

Introduction

Calcitrol or active Vitamin D3 is often called "Sunshine Vitamin" because its invitro synthesis requires exposure to sunlight. It has been subject of immense interest and extensive researches of 21st centuries. It's a byproduct of cholesterol metabolism and is synthesized in the skin following exposure to ultra-violet light which is a part of sunlight[1]. At the metabolism level the step of conversion of 7-Dehydrocholesterol to cholecalciferol requires UV-B light which is a component of sunlight. In Individuals who are not exposed to sunlight because of any reason (Housewives remaining in homes all the times, Bedridden patients, Young girls using excessive sunscreen while going out, Women going out totally covered and individuals belonging to high socioeconomic status usually remaining in air-conditioned offices and restricted to homes and cars) this important step of biosynthesis of cholecalciferol from 7-Dehydrocholesterol is hampered and consequently active Vitamin D is not synthesized properly leading to Vitamin D insufficiency or deficiency depending upon the amount of exposure to sunlight. The effects of non-exposure to sunlight are exaggerated if the woman is pregnant (increased demand) or if she is taking food which is also deficient in vitamin D (decreased Intake). The secondary causes of vitamin D deficiency include malabsorption syndromes (Being fat soluble vitamin its absorption is affected in the conditions causing fat malabsorption), Use of certain drugs (Antiepileptic, steroids and antiretrovirals) and chronic hepatic or renal failure[2].

The role of vitamin D in women's health is diverse. There is more to vitamin D than the calcium metabolism and bone mineral deposition. The other functions of Vitamin D include its effects on kidneys, bones, intestines. It also affects gene expression and is critical for phosphorus homeostasis. Recent researches have proved it to be significantly affecting cell differentiation, proliferation and immunity. It is also important in prevention of cardiovascular disease, neoplasias, psoriasis, multiple sclerosis and hypertension[3]. One of the important and interesting aspect of vitamin D deficiency is that many studies have found the individuals with vitamin D deficiency to be suffering from recurrent respiratory tract infections and recurrent wheeze related lower respiratory tract infections which can be a forerunner of development of asthma in later life. This aspect is important from the view of a pulmonologist[4].

Vitamin D deficiency in woman of child bearing age group not only affects the woman but also is detrimental to her unborn child. In pregnancy there is an increased demand of calcium and vitamin D. Many researchers have reported Vitamin D or Calcium deficiency during pregnancy to be associated with adverse pregnancy outcome. It may effects fetal bone mineralization and may cause intrauterine growth retardation. In immediate postnatal period it may cause neonatal hypocalcaemia seizures[5].

We conducted this comparative observational study with an objective to find out status of vitamin D in women of child bearing age in the twin Cities of Hyderabad and Secundrabad. Our emphasis in this study was to compare the vitamin D levels in women who are not exposed adequately to sunlight with women who were adequately exposed to sunlight.

Materials and Methods

This was a prospective observational study conducted at a tertiary care medical centre located in a metropolitan city of India. The study was undertaken after due permission from institutional ethical committee. 36 healthy females of child bearing age group who were found to be inadequately exposed to sunlight were compared with equal number of females of same age group who were found to have been exposed adequately to sunlight. The women were included on the basis of predefined inclusion criteria. Women with any exclusion criteria were excluded from the study. The exposure to sunlight was determined on the basis of a pre-formed questionnaire. Those patients with comorbidities like severe systemic illnesses, tuberculosis and any other significant illness were excluded from the study. Also those females who may have conditions affecting Vit D or calcium levels like disorders of thyroid or parathyroid glands, women who were on antiepileptic or antiretroviral drugs etc were excluded. Detailed history was taken and thorough clinical examination was done in all the patients. The objective that we were trying to figure out was how Vitamin D levels are affected in women of child bearing who were not adequately exposed to sunlight in comparison with those women who were adequately exposed to sunlight. Adequate exposure to sunlight was defined as direct exposure to sunlight at least for 90-120 minutes during a day. The BMI was calculated and other parameters such as the Vitamin D levels, ALP and the serum Calcium were measured by appropriate laboratory tests.

The samples were collected and sent to the laboratory with association with a reference lab. All the samples were properly sent observing the standard protocols. All the results obtained were documented and a statistical Analysis was done on the figures that were obtained.

The data was analyzed using appropriate statistical methods. P value less than 0.05 was taken as statistically significant. Data analysis was carried out using SPSS 16.0 version software. Microsoft word and excel were used for generating charts and graphs. Cases (included on the basis of inclusion and exclusion criteria) were compared with women of same characteristics who were determined to be adequately exposed to sunlight (Control group).

Inclusion Criteria

- All women between the age of 18- 45 years who were found to have not been adequately exposed to sunlight.

Exclusión Criteria

- Pregnant Females
- Women having severe systemic illnesses, malabsorption syndromes.
- Women having tuberculosis.
- Women with any disease affecting calcium metabolism like hypoparathyroidism, hyperparathyroidism or thyroid disorders.
- Patients on drugs known to cause fluctuations in Sr calcium levels like women on anticonvulsants, glucocorticoids or antiretroviral drugs.

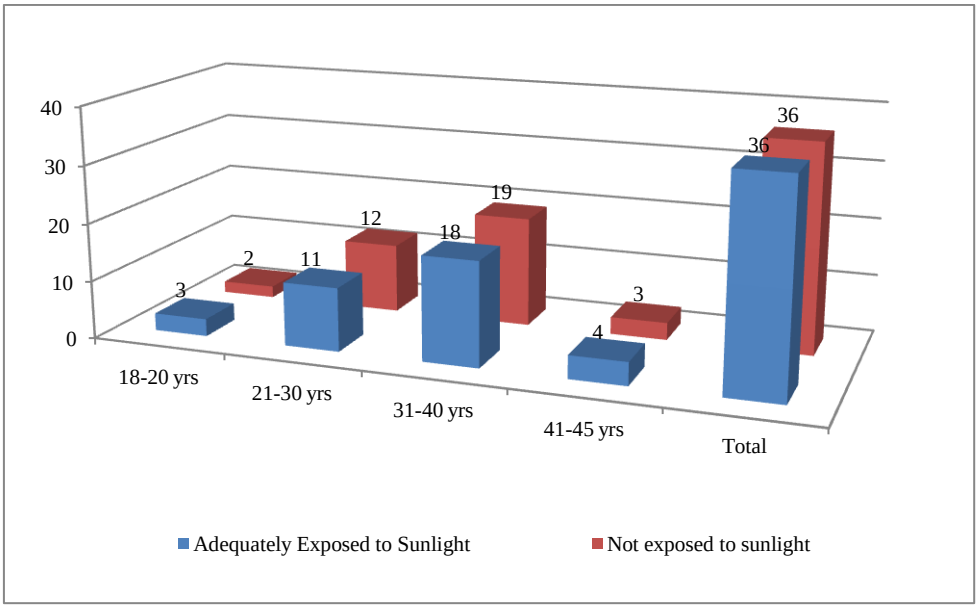
Results

A total of 72 healthy females of child bearing age group were who were either adequately exposed to sunlight (Control group) or not adequately exposed to sunlight (cases) were compared in this comparative observational study. Adequate exposure to sunlight was defined as direct exposure to sunlight at least for 90-120 minutes during a day. The analysis age group of the patients revealed that majority of the patients belonged to the age group of 30-40 years. The minimum age was found to be 19 years and maximum age was 42 years.

Table 1: Age distribution of the studied cases

Age group	Adequately exposed to sunlight		Not adequately exposed to sunlight	
	N	%	N	%
18-20 years	3	8.33 %	2	5.55 %
21-30 years	11	30.55 %	12	13.33 %
31-40 years	18	50%	19	52.77 %
41-45 years	4	11.11 %	3	8.33 %
Total	36	100%	36	100%

Figure 1: Age distribution of the studied cases



The analysis of the data collected from the women who were inadequately exposed to sunlight revealed that the common causes of non-exposure to sunlight included housewives remaining in homes for daily household work and it was not possible for them to be exposed to sunlight for 90-120 minutes every day followed by working women who remained in either office or homes and women not exposed to sunlight due to the way of clothing.

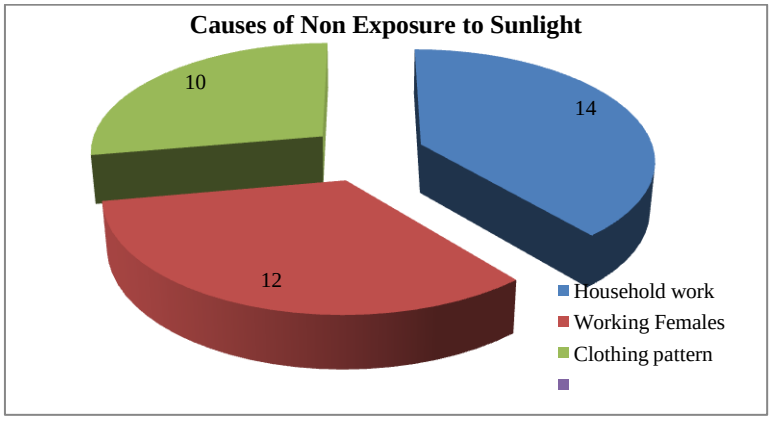
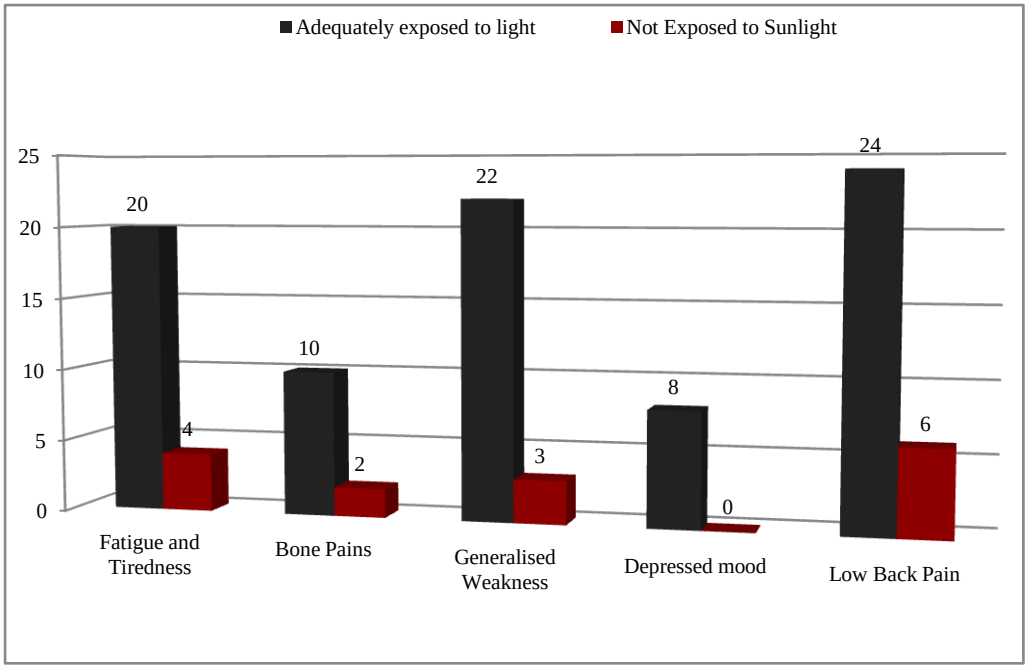


Figure 2: Factors affecting exposure to sunlight in the studied cases.

Comparison of signs and symptoms which might be attributed to vitamin D deficiency in the studied cases revealed that the symptoms like fatigue and tiredness, bone pain, generalized weakness and depressed mood and low back pain were more common in women who were not adequately exposed to sunlight in comparison with those who were adequately exposed to sunlight.

Figure 3: Comparison of signs and symptoms in both the groups.



Finally analysis of different demographic factors and laboratory investigations in both the groups (ie patients who were adequately exposed to sunlight Vs those who were not adequately exposed to sunlight) was done. Values were tabulated and P values were determined. Findings of these factors are given in tabulated form.

Table 2: Demographic and Laboratory Data in the studied cases

Variable	Adequately Exposed To Sunlight		Std.Err.	Not adequately exposed to sunlight		Std. Error	T Test	Probability	Mann Whitney	Probability
Weight	59.385	±	2.723	64.348	±	3.521	0.968	0.340	126.00	0.222
Height	5.352	±	0.047	5.178	±	0.035	2.965	0.006	75.000	0.006
BMI	22.347	±	1.080	25.742	±	1.299	1.772	0.085	104.000	0.067
Serum Ca^{+}	8.869	±	0.126	8.635	±	0.121	1.257	0.217	109.000	0.091
ALP	98.308	±	7.972	104.043	±	4.770	0.658	0.515	116.000	0.136
Vit-25 OH nmol/lit	96.279	±	8.962	73.403	±	4.429	2.565	0.015	78.000	0.008

The Above table shows the significant difference between 25 (OH) Vitamin D levels in women who were adequately exposed to sunlight and those who were not adequately exposed to sunlight (96.27 nmol/lit in those adequately exposed to sunlight Vs 73.403 nmol/lit in those who were not adequately exposed to sunlight). The P Value for 25 (OH) vitamin D levels in 2 groups was found to be 0.008 and hence the difference was statistically highly significant. The data apart from the link between exposure to sunlight and low vitamin D levels showed that a link between sun exposure and ALP also existed and ALP was found to be higher in those who were not adequately exposed to sunlight. Finally comparison of Vitamin D levels between these 2 groups was done which showed that Vitamin D levels were lower in women who were not adequately exposed to sunlight in comparison with control group.

Table 3: Vitamin D levels in both the groups.

Variable	Adequately Exposed To Sunlight		Std. Err.	Std. Dev.	Not adequately exposed to sunlight		Std. Err.	Std. Dev.	T Test	Probability	Mann Whitney	Probability
VIT D ngm/ml	15.317	±	0.982	4.711	14.630	±	1.127	4.063	0.440	0.662	121.000	0.175

Discussion

No age group is immune to the development of Vitamin D deficiency despite presence of plenty of sunshine in our country. Strict vegetarians, Obese, Individuals with sedentary life style and those who remain restricted to air-conditioned confines of their homes, offices and cars are more prone for developing vitamin D deficiency. In Women of child bearing age group it may cause various symptoms like chronic fatigue, low back pain and emotional disturbances. In pregnancy the requirement of calcium and Vitamin D increases and hence borderline vitamin D insufficiency may start manifesting during pregnancy. Vitamin D deficiency in pregnancy has been found to be responsible for adverse pregnancy outcome, fetal growth restriction and hypocalcemic seizures in early neonatal period[6].

By virtue of being a hormone Vitamin D has many known and unknown effects on various systems of the body. It is thought to have targets over hundreds of genes in the human body. Vitamin D deficiency is found to be associated with, in some or the other ways, conditions like cardiovascular and neoplastic diseases, stroke, autoimmune conditions, diabetes and hypertension, stroke, osteoarthritis and osteoporosis, myopathies, dental problems, depression and hyper-responsive airway diseases[7].

Currently a level of at least 30 ng/ml 25(OH) D is considered as sufficient, values between 29 and 20 ng/ml as insufficiency, levels less than 20 ng/ml as deficiency and levels below 7 ng/ml as severe deficiency. The World Health Organization (WHO) defined vitamin D insufficiency as serum level of 25 (OH) D below 20 ng/ml (50 nmol/liter). However, other researchers recently started to define vitamin D deficiency as serum 25 (OH) D level below 20 ng/ml and vitamin D insufficiency as less than 30 ng/ml (75 nmol/liter). The implications of change in the levels to define vitamin D insufficiency and deficiency are immense because it would bring more people in the ambit of therapeutic doses of vitamin D thus preventing complications associated with vitamin D deficiency[8].

One of the important factors contributing to vitamin D deficiency includes inadequate exposure to sunlight. With change in lifestyles more and more people are remaining to confines of their offices, homes or transport vehicles. Moreover there is drastic decrease in outdoor sporting activities leading to inadequate exposure to sunlight. Daily exposure of 90-120 minutes exposure to sunlight is considered as adequate exposure to sunlight. Needless to say there are many people who are not exposed to this amount of sunlight daily. These persons especially women are prone for developing vitamin D insufficiency and its complications. Moreover women of child bearing age group who are not exposed to sunlight for some or the other reason are more prone for developing complications of vitamin D deficiency due to high demand. If such women have other contributory factors like dietary deficiency (strict vegans) or malabsorption then severe deficiency of vitamin D may occur[9].

Our study of women of child bearing age group who were not adequately exposed to sunlight because of the reasons of household work, working females or dressing style showed that women not exposed to adequate sunlight (90-120 minutes per day) were having mean 25 (OH) vitamin D levels in the range of insufficiency. This finding was similar to the findings as reported by many western authors.

The findings of this study emphasized the importance of adequate exposure to sunlight in

females of child bearing age group. A balance needs to be stricken between side effects of excessive exposure to sunlight (melanoma, sqaumous cell or basal carcinoma) and inadequate exposure to sunlight causing vitamin D deficiency. It must be emphasized that those individuals who have some unavoidable reasons for not being exposed to adequate sunlight (H/o melanoma, basal cell carcinoma or bed ridden patients etc) should be supplemented with food rich in calcium and Vitamin D (Non-veg food, milk, fatty fish, egg yolk, cheese or food supplement fortified with vitamin D). Documented Vitamin D deficiency must be treated by appropriate doses of vitamin D[10].

Conclusion

Vitamin D deficiency can have effects on almost each and every system of the body. Women of child bearing age group who are not exposed to adequate sunlight are predisposed for developing Vitamin D insufficiency and deficiency. These women should be advised adequate exposure to sunlight (90-120 minutes /day) and food items rich in vitamin D. Patients with documented Vitamin D insufficiency or deficiency must be treated by appropriate doses of calcium and Vitamin D.

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References

1. Nair R, Maseeh A. Vitamin D: The "sunshine" vitamin. Journal of Pharmacology and Pharmaco therapeutics. 2012;3(2):118-126.
2. Williams S, Malatesta K, Norris K. Vitamin D and Chronic Kidney Disease. Ethnicity & disease. 2009;19(4 Suppl 5):S5-8-11.
3. Gouni-Berthold I, Krone W, Berthold HK. Vitamin D and cardiovascular disease. Curr Vasc Pharmacol. 2009 Jul;7(3):414-22.
4. Shruti N Dhale, Md Ashfaque Tinmaswala Association of Recurrent Respiratory Tract Infections with Vitamin D Deficiency Bombay Hospital Journal, Vol. 57, No. 2, 2015
5. Camadoo L, Tibbott R, Isaza F. Maternal vitamin D deficiency associated with neonatal hypocalcaemic convulsions. Nutrition Journal. 2007;6:23.
6. Amegah AK, Klevor MK, Wagner CL. Maternal vitamin D insufficiency and risk of adverse pregnancy and birth outcomes: A systematic review and meta-analysis of longitudinal studies.PLoS One. 2017 Mar 17;12(3)
7. Naeem Z. Vitamin D Deficiency- An Ignored Epidemic. International Journal of Health Sciences. 2010;4(1):V-VI.
8. Palacios C, Gonzalez L. Is vitamin D deficiency a major global public health problem? The Journal of steroid biochemistry and molecular biology. 2014;144PA:138-145.
9. Thacher TD, Clarke BL. Vitamin D Insufficiency. Mayo Clinic Proceedings. 2011;86(1):50-60.
10. Kennel KA, Drake MT, Hurley DL. Vitamin D Deficiency in Adults: When to Test and How to Treat. Mayo Clinic Proceedings. 2010;85(8):752-758.