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"ASSESSMENT OF VITAMIN D STATUS IN DIFFERENT WORKING GROUPS & THE ROLE OF VITAMIN D SUPPLEMENTATION- A PILOT STUDY"

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ABSTRACT

Background: Though vitamin D deficiency can occur due to lack of sunlight exposure, to what extent deficiency occurs in relation to duration of sunlight exposure is not known. Hence this study was undertaken to estimate vitamin D level in different occupational groups which had different duration of sunlight exposure. **Aim:** To assess vitamin D status in different occupational groups. **Methodology:** A Prospective observational study was conducted with 20 Construction workers (CW), 20 Information Technology Day (ITD) and 20 Night IT (ITN) employees in Chennai. Vitamin D, calcium, phosphorus and blood sugar levels were assessed for all 3 groups. Those who had vitamin D deficiency(<20ng/ml) were given vitamin D 60000 IU weekly for 8 weeks and above parameters reassessed. Results were analyzed using SPSS version 21. **Results**: Mean baseline vitamin D level in CW was 26ng/ml, 23ng/ml in ITD and 16ng/ml in ITN. Three in ITD had vitamin D >100ngl/ml and were excluded from study. 8 had normal vitamin D, 20 had insufficiency and 29 had deficiency. After vitamin D supplementation to the deficient group, vitamin D reached normal in 26 subjects and 3 to insufficient status. Post treatment level was 68.36ng/ml in CW, 50.06ng/ml in ITD and 44.19ng/ml in ITN groups. The proportion of increase was marked in CW. There was increase in calcium, phosphorus and decrease in blood sugar after vitamin D supplementation in all three groups. **Conclusion:** IT night workers are at a great risk of developing vitamin D deficiency and they can adopt occupational modifications or have rotating shifts to get adequate sunlight exposure.

KEYWORDS: Vitamin D, IT, Construction, Calcium level, blood sugar.

INTRODUCTION

Vitamin D deficiency has become pandemic worldwide.[1] In India at present vitamin D deficiency is a major health problem irrespective of abundant sunshine.[2,3] 50-90% of Indian population in all age groups is found to be vitamin D deficient due to lack of sunlight exposure.[4] The cause for vitamin D deficiency is attributed to due to lifestyle modification like confinement to indoor works for longer periods, improper diet and increase in use of sunscreens.[5, 6] More than 20% of the world populations are working in shifts which lack exposure to sunlight.[7] As the maximum absorption of UVB rays necessary for the synthesis of vitamin D takes place during day time, indoor jobs and night shifts prevent absorption of UVB rays resulting in vitamin D deficiency. It is evident from the increasing incidence of vitamin D deficiency that people lack even such short period of sun light exposure. Hence it is decided to study the correlation between occupations with different degrees of sunlight exposure and vitamin D deficiency.

AIM: To study the correlation between occupation and Vitamin D status in different working groups

OBJECTIVES

- To estimate Vitamin D level among different working groups (Day and night workers).
- To estimate blood sugar, calcium and phosphorus among different working groups.
- To assess the correlation among the different groups.

SUBJECTS AND METHODS

Participants were recruited from two sites which had different degrees of sunlight. One, the construction site in Kelambakkam, a suburb of chennai which had maximum sunlight and the second from IT companies in Sholinganallur, Chennai, Tamilnadu.

Inclusion Criteria: Workers exposed to sunlight such as construction workers (CW) and IT day workers (ITD),

workers minimally exposed to sunlight like IT night workers (ITN), age 18 and above, both male & female, duration in the current occupation - 3 months and above.

Exclusion criteria: Subjects who are on vitamin D supplementation, those suffering from chronic diseases like hepatic, renal and dermatological disorders, diabetes, hypertension, alcoholism & smoking, post-menopausal women, pregnant & lactating mothers, individuals on medications which can cause vitamin D deficiency and those who use sunscreens.

Subject enrollment

A total of 60 participants, 20 from each group were recruited from CW, ITD and ITN. A signed informed consent was obtained from all the subjects in each group prior to the study.

Vitamin D status

Vitamin D status was categorized as normal (30–100 ng/ml), insufficient (20–29 ng/ml) and deficient (<20 ng/ml).[8]

Sample Collection and analysis

5 ml of blood was collected from all the 60 participants in their respective working areas and blood levels of vitamin D , calcium, phosphorus and sugar were assessed. Among the 60, 29 were found to have vitamin D deficiency and they were given vitamin D supplementation at the dose of 60000 IU a week for 8 weeks. All the above parameters were reassessed for them at the end of 8 weeks treatment. The results were then analyzed for statistical significance using one way ANOVA and student t test.

RESULTS

All the 60 participants who were recruited to the study completed the study. There were 44 males and 16 females. 15 males and 5 females in CW, 13 males and 7 females in ITD and 16 males and 4 females in ITN. They were aged between 21 to 37 years. Males were between 21 to 37 years and females 23 to 35 years.

Vitamin D level was normal (38.79ng/ml) in 8 subjects totally (13%). Among them 6 were from CW and 2 from ITD group. 20 were found to be in insufficient status, 12 from CW, 6 from ITD and 2 in ITN group. 29 participants were vitamin D deficient (48%). In the deficient group 18 were in ITN group (90%), 9 in ITD group (45%) and 2 in the CW group (10%).3 subjects in the ITD group had vitamin D level above 100ng/dl and they were excluded from the study. The serum vitamin D level was 26.33ng/ml in the CW group, 23.08ng/ml in ITD group and 16.01ng/ml in ITN group. Vit. D level was found to be lower in ITN group while compared to the other two groups (Fig 1). The difference between ITN and CW group was found to be statistically significant (P< 0.05). But the difference between ITD and CW group was not found to be statistically significant.

The mean serum calcium level was 9.315mg/dl in the CW group whereas in ITD and ITN it was 9.12mg/dl and 8.6mg/dl (Fig 2). The difference was statistically significant between CW group and ITN group (P<0.05). The mean serum phosphorus level in the CW group was 3.76mg/dl, 3.55mg/dl in ITD and 3.61mg/dl in ITN group. The mean blood sugar was 91.95mg/dl in CW group, 101mg/dl in ITD and 93.80mg/dl in ITN group. There was no statistical significance in serum phosphorus and blood sugar level among the 3 groups (Fig 3, 4).

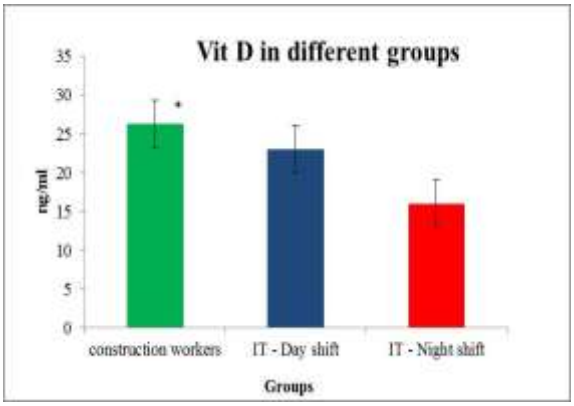

Fig .1

Serum Vitamin D level

One way ANOVA followed by post hoc Tukey test, *P<0.05 Construction compared with ITN

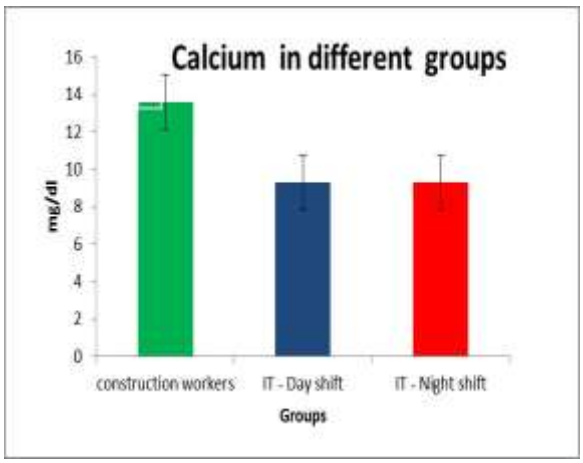

Fig .2

Serum Calcium level

One way ANOVA followed by post hoc Tukey test, *P<0.05 construction compared with ITN

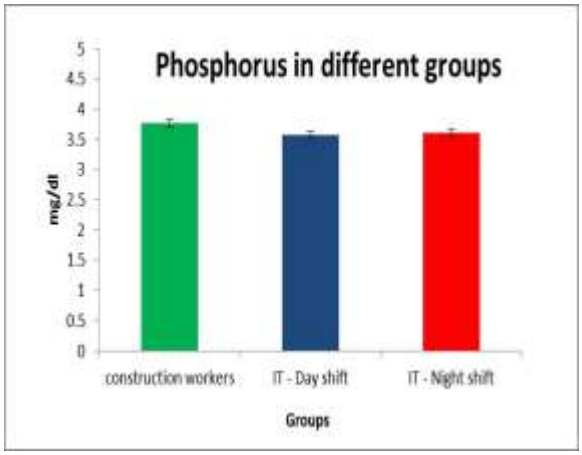

Fig .3

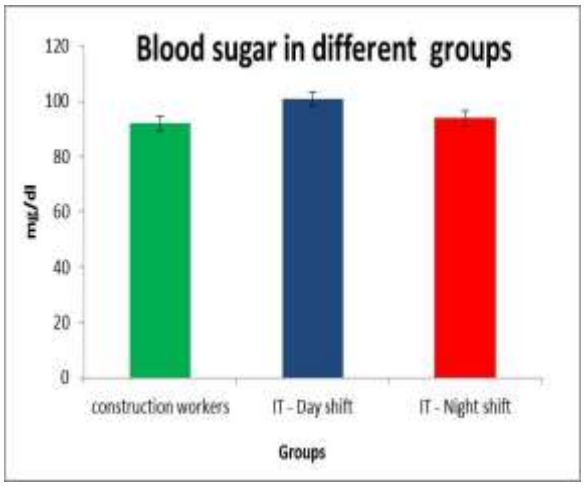

Fig .4

Vitamin D supplementation was given to 29 participants who had been identified as vitamin D deficient, at the dose of 60000 IU once a week for 8 weeks. After supplementation vitamin D reached normal in 26 and insufficient status in 3 participants. The mean vitamin D level increased from 16.31ng/ml to 47.68ng/ml after supplementation and there was almost 3 fold increase in vitamin D level. The proportion of increase was higher in the construction group with a difference of 49.62ng/ml from baseline, with ITD 32.43ng/ml and ITN 28.85ng/ml. The difference was significant statistically between CW group and ITN group. There was an increase in mean serum calcium from 8.72mg/dl to 9.26mg/dl and mean serum phosphorus level from 3.57mg/dl to 3.81mg/dl and a decrease in the mean blood sugar level from 96.82mg/dl from 93.31mg/dl after vitamin D supplementation but this difference was not found to be statistically significant.

DISCUSSION

The current study was conducted with an objective of finding out vitamin D level in different occupational groups which had varying duration of sunlight exposure. A total of 60 subjects from 3 different occupational groups, CW, ITD and ITN workers were included in the study. Out of 60 subjects 29 had vitamin D deficiency (<20ng/ml). Among the 29, 18 were ITN workers (62%), 9 ITD (31%) and 2 CW (7%). Vitamin D deficiency was found to be low in the CW group whereas high in the ITN group. The two subjects who had Vit. D deficiency in the CW group were women in construction work for the first time. The reason for the low incidence of Vit D deficiency in CW can be explained by the long duration of sun light exposure they had throughout the day. Though the night workers may get opportunity to go out in the sun light during day time unlike the day workers who remain indoor throughout the day, Vit D deficiency was high in night workers in our study. Whether nutritional deficiency due to improper diet intake like skipping of meals while sleeping during day time would have contributed to deficiency has to be studied.

After vitamin D supplementation to the deficient group vitamin D reached normal in 26 subjects and 3 to insufficient status. The proportion of increase in vitamin D level from baseline was found to be greater in the CW than the others establishing the relationship between the duration of sunlight exposure and Vit D level.

Association between night work and vitamin D status was studied by Itoh H, et al[9] and in their study no association was found between the two. It could be due to the smaller sample size used in that study (14 subjects), whereas in the present study 40 indoor workers were evaluated and positive correlation between night work and vitamin D deficiency was observed.

It is suggested that 30 minutes of sun light exposure between 10 am and 2 pm, 3-4 times a week without any protection like sunscreen or clothing is necessary for adequate synthesis of Vit D.[10] Hence an average duration of 1.5 - 2 hours sunlight exposure per week is necessary to prevent Vit D deficiency. It is evident that the night shift group in our study did not have this exposure.

In a study conducted by smith et al among antarctic men on the effect of three doses of Vit D, it was found that those subjects who received food fortified with Vit D as well as Vit D supplementation but deprived of sunlight had low Vit D than those who had sunlight exposure.[11] This shows that food fortification and Vit D supplementation are not sufficient and sunlight exposure is the essential factor for maintaining normal Vit D status.

With regard to gender difference 18 out of 44 males (41%) and 11 out of 16 females (69%) had Vit. D deficiency. The higher incidence in females could be due to the difference in the degree of sunlight exposure between two sexes and gender related sensitivity to UVB radiation.[12]

The mean calcium level in the subjects who had normal vitamin D was 9.16mg/dl and that of vitamin D deficient individuals was 8.72mg/dl. The difference was found to

be highly statistically significant (P<0.0004) establishing the correlation between vitamin D and calcium. Such a combined deficiency may contribute to osteoporotic disorders. Hence adequate sunlight exposure may not only prevent vitamin D deficiency but also calcium deficiency and the related disorders. Lu YY et al have reported that supplementation with Vitamin D for 3 months has resulted in improvement in bone density, secondary hyperparathyroidism and frequent tetany in a child with hypocalcaemic tetany with intestinal lymphangiectasia.[13] Intestinal lymphangiectasia can cause malabsorption of fat and reduced cholesterol synthesis which in turn can result in decreased Vit D synthesis as well as calcium level.

The mean phosphorus level in subjects with normal Vit D was 3.96mg/dl and that of Vit. D deficient individuals was 3.57mg/dl. Both the values were within normal range and the difference was not found to be statistically significant (P< 0.09).

The mean blood sugar level was 90.63mg/dl and 96.83mg/dl in normal and vitamin D deficient individuals respectively and the difference was not significant (P< 0.43). Hypo vitaminosis D has been linked to hyperglycemia, type 2 diabetes and metabolic syndrome.[14] But such a correlation between vitamin D deficiency and blood sugar level was not observed in the present study. Systematic review and meta analysis on the effect of vitamin D supplementation on glycaemic control and insulin resistance did not reveal a beneficial effect of vitamin D therapy in diabetes mellitus.[15]

Thus in this study supplementation with vitamin D did not only result in increase of vitamin D but also calcium as well as phosphorus but a decrease in blood sugar level from the baseline. The increase in calcium level was statistically significant but the difference in phosphorus and blood sugar was not found to be significant. The reduction in blood sugar though not statistically significant would contribute to the maintenance of glycemic control in diabetic patients.

Vitamin D deficiency is linked with increased risk of developing diseases such as TB[16,17], otitis media[18], upper respiratory tract infections[19] and influenza.[20] People living in higher latitudes have increased risk of developing hypertension, type I diabetes, obesity and increased levels of triglyceride.[21] Vit D deficiency also increases the risk of colon, breast, prostate and ovarian cancers [22-28] and autoimmune disorders [rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease][29] and type II diabetes.[30] Hence correction of Vit D deficiency is mandatory to prevent risk of developing these diseases.

The current study has thus established that occupations with lack of sunlight exposure lead to vitamin D deficiency. Inadequate sunlight exposure has not only influenced vitamin D but also calcium. Supplementation with vitamin D has positively influenced both vitamin D and calcium and but not significantly altered blood sugar and phosphorus level.

CONCLUSION

The current study has shown that vitamin D deficiency is occupation related and confirmed that occupations involving limited sunlight exposure contribute to vitamin D deficiency. Supplementation with vitamin D at the dose of 60000IU per week for 8 weeks has reversed the deficiency in 90% of the participants as well as increased calcium level and decreased blood sugar level. Night shift employees can be on rotating shifts where they get opportunity for atleast 2 hours duration of sunlight exposure every week. Periodic assessment of vitamin D in indoor workers will help identify vitamin D deficiency early and take corrective measures. Maintaining adequate level of vitamin D level is essential to prevent vitamin D deficiency linked disorders.

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