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Hypovitaminosis D in Various Age Groups and its Effect on Office Worker and Non Office Worker: A Cross-Sectional Study

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ABSTRACT

Introduction: Vitamin D is known to be a key regulator of bone metabolism and is associated with muscle strength. Its deficiency is rampant worldwide, but some groups are at greater risk.
Aim: We aim to evaluate vitamin D levels in different age group and identify office going groups and non office going group vulnerable to vitamin D deficiency.
Material and Methods: We here by analyze vitamin D levels of various sex and age group people tested in SRL diagnostic lab at Patna from May 2021 to April 2022. Further were categorized in office going group and non office going group. According to their serum 25-hydroxyvitamin D (25(OH)D) levels, the patients were further grouped into either the deficiency group (25(OH)D<20 ng/mL), insufficiency group (25(OH)D- 20 to <30.0 ng/mL) and sufficiency group having >30ng/ml. Hypovitaminosis D included both deficiency and insufficiency group. The differences between the 2 groups were compared. We used a Chi-squared test to determine the significance of differences between proportions for hypovitaminosis D between office going and non office going groups. A p-value of <0.05 was considered statistically significant.
Result: Out of 993 cases the overall average vitamin D level for all the cases are 24.004±20.87. Out of total cases 58.50% cases were female and 41.49% cases were of male patients. In female patients 71% cases had hypovitaminosis D where as 79% male patient had hypovitaminosis D. Different age groups were formed where group I included 0-12years, group II included 13-19years, group III included 20-39years, group IV included 40-59years and group V included >60years. Hypovitaminosis D (deficiency and insufficiency) was seen in 79% population of group I and II, 78% group III, 71% group IV and 66% group V. 35% population were office going and other 75% population was non office going which almost included similar percentage of male and female population in both the groups i.e. 40% male population and 60% female population. In office going population 83% male population had hypovitaminosis D where as 72% female population had hypovitaminosis D.
Conclusion: In conclusion, a high prevalence of vitamin D deficiency was noted among infant, children, adolescents and elderly despite the abundant sunshine. Compared to females, males were more likely to have vitamin D insufficiency, and male gender appears to be a risk factor for vitamin D insufficiency. This may reflect strong sun avoidance behavior among all the age group. Occupation as such in this study had no direct role on vitamin D status.

Keywords: Vitamin D, Deficiency, Insufficiency, sufficient, Office going, children

INTRODUCTION

Vitamin D plays a crucial role in human health. It is an essential vitamin for the health and growth of bones. It is also vital for calcium and phosphorus metabolism.**[1]** Low levels of vitamin D can significantly impact a person's physical and mental well-being. **[1]** The 1,25-

dihydroxyvitamin D3 (calcitriol) is the biologically dynamic form of vitamin D whereas 25-hydroxyvitamin D (25OHD) is the major circulating metabolite. **[3]** Low levels of 25-hydroxy vitamin D [25(OH)D], the primary circulating storage form of vitamin D, are present in 30%-50% of otherwise healthy middle-aged to elderly adults. Risk factors contributing to vitamin D deficiency in older adults include condensed nutritional intake of vitamin D, increasing adiposity, decreased cutaneous synthesis of vitamin D, and less time spent outdoors. **[4]** Vitamin D are absent in many food items, therefore the amount of time in sunlight is the important source of vitamin D. **[2]**

Recently, vitamin D deficiency has become very common in both adults and children, due to a lack of coverage to sunlight. **[2]** As such, this study aimed to investigate the prevalence of vitamin D deficiency, in children and adults.

Further vitamin D synthesis is highly dependent on sunlight, factors and conditions associated with decreased time spent outdoors can be expected to unfavorably impact vitamin D status. Office workers that occur to stay in the office traditional from 9 a.m. to 5 p.m can plausibly be expected to have lower serum vitamin D levels. Therefore, this study highlights the vitamin D levels in different age group and identifies office going groups and non office going group vulnerable to vitamin D deficiency.

MATERIAL AND METHODS

We here by analyze vitamin D levels of various sex and age group people tested in SRL diagnostic lab at Patna from May 2021 to April 2022 which included 993 cases. Further cases were categorized in office going group and non office going group. Non office going groups included school/college going students, house wife and retired officers who are now staying at home. According to their serum 25-hydroxyvitamin D (25(OH) D) levels, the patients were further grouped into either the deficiency group (25(OH) D<20 ng/mL), insufficiency group (25(OH)D- 20 to <30.0 ng/mL) and sufficiency having >30ng/ml^2. The differences between the groups were compared.

Statistical methods

The data obtained was entered into Excel sheet and analyzed using the statistical package for the social sciences version 17 statistical program (SPSS Inc. Chicago). Frequencies and percentage of all variables were computed. We calculated the pooled average metabolite level as mean ± SD; deficiency/insufficiency status was described as % of the total number of subjects in a given category. We used a Chi-squared test to determine the significance of differences between proportions of vitamin D deficiency or deficiency/insufficiency between office going and non office going groups. A p-value of <0.05 was considered statistically significant.

RESULTS

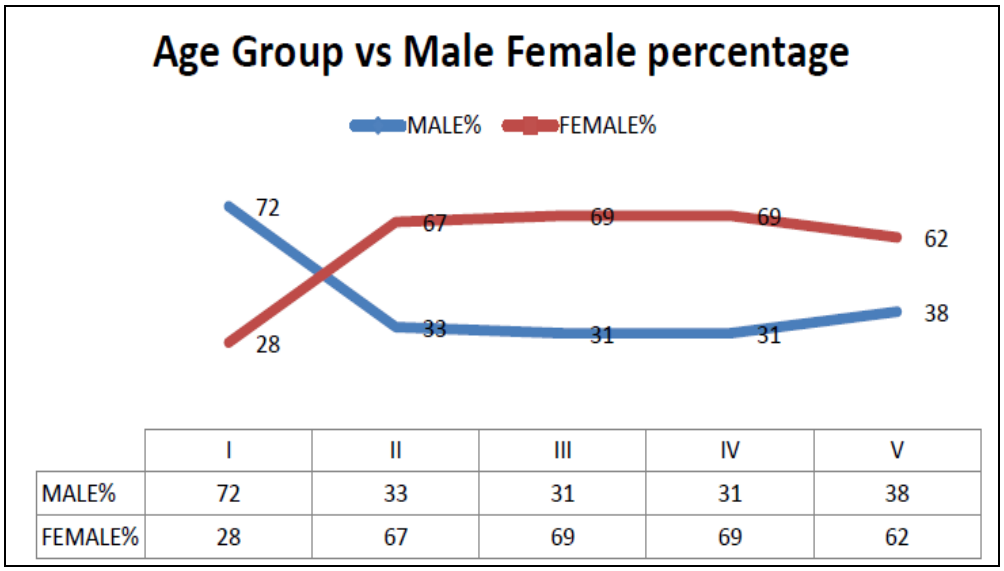
Out of 993 cases the overall average vitamin D level for all the cases are 24.004±20.87. Out of the total cases 55.89% cases had deficiency of vitamin D with an average vitamin D level of 11.44ng/dl, 18.93% cases had insufficiency where average level of vitamin D was 24.57ng/dl and 25.17% cases had sufficiency level of vitamin D with average value of 51.45ng/dl.

Out of total cases 58.50% cases were female and 41.49% cases were of male patients. In female patients 52% cases were deficient of vitamin D, 19% cases were having insufficient levels and 29% cases had sufficient level of vitamin D, where as in male patients 61% cases were deficient 18% had insufficient level of vitamin D and 21% cases had sufficient level.

Table 1: vitamin d levels in male and female in different conditions.

Gender	Deficiency	Insufficiency	Sufficiency
Male	11.70±4.53 (61%)	24.55±2.64 (18%)	52.92±29.49 (21%)
Female	11.23±4.81 (52%)	24.58±2.95 (19%)	50.69±20.57 (29%)

Based on different age groups were formed where group I included 0-12years children, group II included 13-19years old population, group III included 20-39years old patients, group IV included 40-59years old middle aged patients and group V included >60years old elderly patients. These groups were further assessed on % male and % female population as described in graph 1.

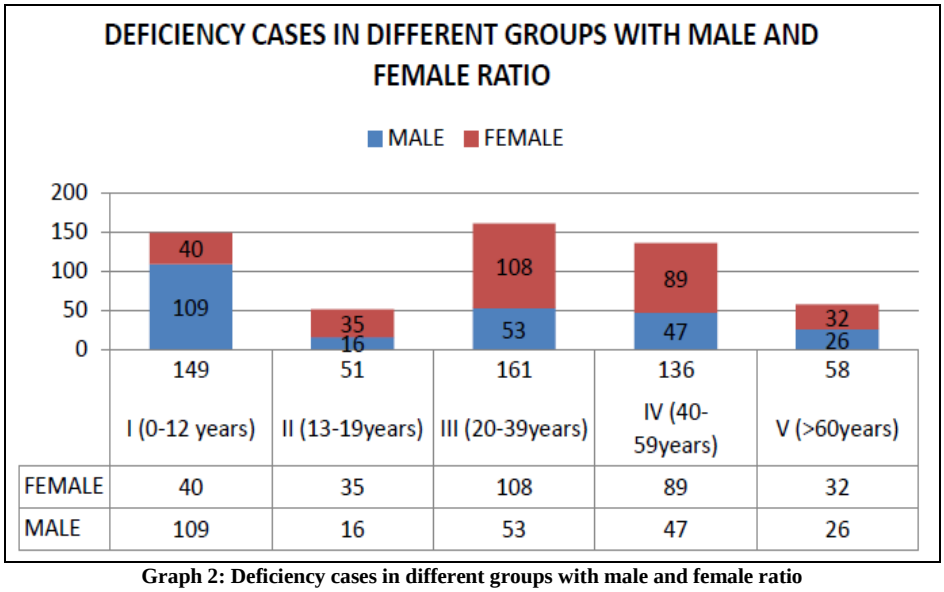


	I	II	III	IV	V
MALE%	72	33	31	31	38
FEMALE%	28	67	69	69	62

Graph 1: Comparison between age group and male female percentage

The group segregated on the basis of age were assessed where group I composed of 22.35% of cases group II had 6.75% of cases group III had 27.5% cases, group IV had 29.4% of cases and group V had 14% cases.

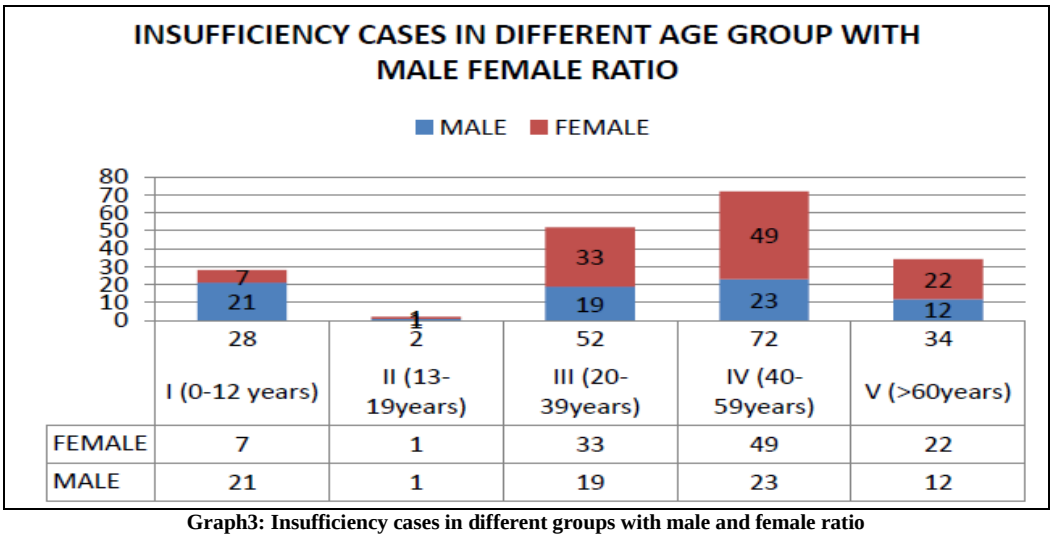
These were further separated into deficiency, insufficiency and sufficiency groups and were transformed into graphs as described below in graph2, graph 3 and graph 4.



FEMALE	40	35	108	89	32
MALE	109	16	53	47	26

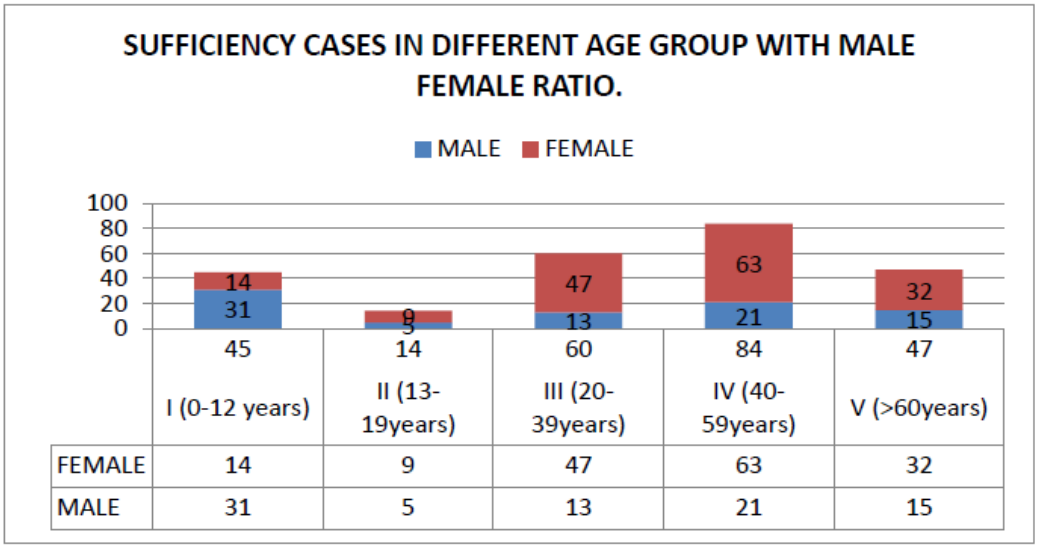
Graph 2: Deficiency cases in different groups with male and female ratio

Vitamin deficiency was seen maximum in Group III (20-39years) having 161 cases with female showing the dominance n followed by group 1 (0-12years) having 149 cases where male predominance was noted and group IV (40-59years) having 136cases where again female preponderance was seen.



Graph3: Insufficiency cases in different groups with male and female ratio

Vitamin D insufficiency was seen maximum in group IV (40-59years) having 72 cases with female preponderance followed and Group III (20-39years) with 52 cases and group V (>60years) having 34cases having with both showing insufficiency more in female patients.



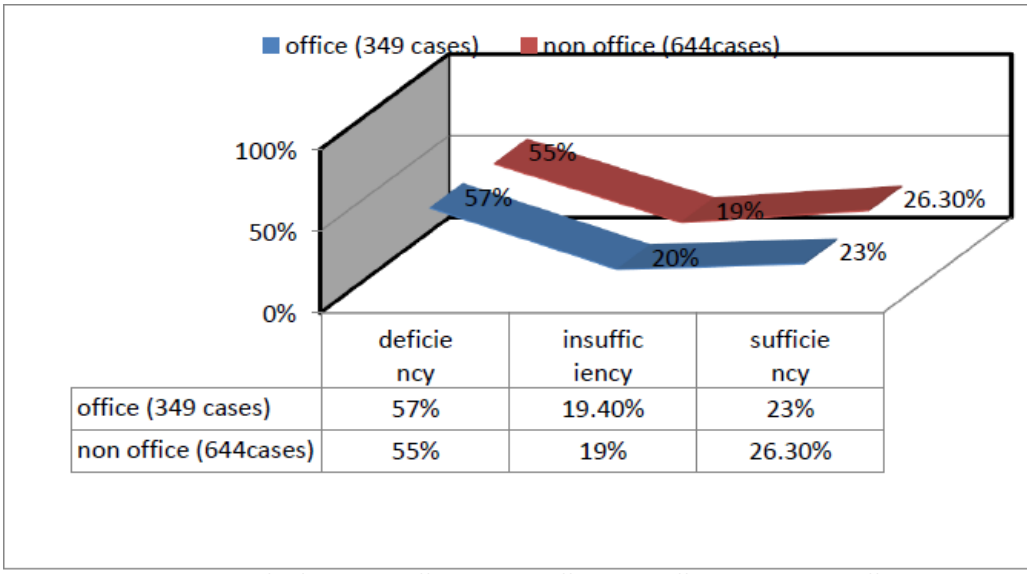
Graph 4: sufficiency cases in different groups with male and female ratio

Out of 25% sufficient vitamin D level the maximum number of cases with sufficient vitamin D levels was noted in group IV (40-50years) with female preponderance followed by group III and group V.

When the total number of cases was separate into office going and non office going group 35% of the cases were office going and rest 65% patients was non office going. However 235 cases (24%) were school/college going students who were also mostly indoor workers and not exposed enough to the sunlight. When evaluated it showed 65% cases had deficiency of vitamin D in school/college going patients. 13% cases were in insufficiency level and 22.2% cases had sufficient amount of vitamin D.

25 cases out of 993cases were newborn and were of less than 5days old. 40% cases were vitamin D deficient, 20% were insufficient and 40% had sufficient levels of vitamin D.

When office and non office group were further evaluated of the basis of deficiency, insufficiency and sufficiency level of vitamin D there was no difference observed between the two groups as shown in graph 5. However there was no correlation between office going and non office going groups with vitamin D levels.



	deficiency	insufficiency	sufficiency
office (349 cases)	57%	19.40%	23%
non office (644cases)	55%	19%	26.30%

Graph 5: showing % cases of deficiency, insufficiency and sufficiency in office going and non office going group.

DISCUSSION

The global control of vitamin D deficiency has reached an alarming proportion. This trend has elicited a significant amount of research interest to elucidate the potential risk of hypovitaminosis D (deficiency and insufficiency). **[3]** In our study 993 cases were evaluated, where patients were grouped into deficiency with 25(OH) D<20 ng/mL, insufficiency group with 25(OH)D levels between 20 to <30.0 ng/mL and sufficiency group having >30ng/ml. 75% cases had hypovitaminosis D [including deficiency (56%) and insufficiency (19%)] 25% cases had sufficient levels of vitamin D. Haimi M et al in their study on a representative sample of the population of Israel in 2010 found that 78% had vitamin D insufficiency (< 30 ng/ mL) which was almost similar to our study. Lee et al in their study found out. the mean 25(OH)-D concentration of the study group was 28.94 ± 10.27 ng/mL and 22.4% had vitamin D deficiency (25(OH)-D concentration < 20 ng/mL). **[9]**

In this cross-sectional study, 993 participants (412 men and 581 women) were recruited with a mean vitamin D level of 22.57±21.33ng/mL in male and 25.01±20.50ng/mL level was found in female however was not same as the study by Koh DH et al where women showed lower vitamin D levels than Men.

In female patients 52% cases were deficient of vitamin D, 19% cases were having insufficient levels and 29% cases had sufficient level of vitamin D, where as in male patients 61% cases were deficient 18% had insufficient level of vitamin D and 21% cases had sufficient level. However in a study by Yan X et al the prevalence of 25(OH) D deficiency and inadequacy was noted in 69% men and 75% women. **[5]** Whereas in our study deficiency was higher in male (79%) than in female this was 71%. Differences in the amount of subcutaneous fat between males and females could be one of main reasons for the gender difference in serum vitamin D levels. It was well known that women on average have more subcutaneous fat than men. **[5]** Vitamin D is fat soluble and subcutaneous adipose tissue can store large amounts of it. Therefore, the greater subcutaneous fat in women takes up

more vitamin D molecules produced from skin. **[5]**

Based on different age, groups were formed where group I included 0-12years children, group II Included 13-19years adolescents, group III included 20-39years old patients, group IV included 40-59years old middle aged patients and group V included >60years old elderly patients.

Hypovitaminosis D (deficiency and insufficiency) was seen in 79% group I and II, 78% group III, 71% group IV and 66% group V.

Vitamin D deficiency was seen maximum in Group III (20-39years) with female showing the dominance is followed by group 1 (0-12years) where male predominance was noted and group IV (40-59years) where female preponderance was seen. Out of 25% sufficient vitamin D level the maximum number of cases with sufficient vitamin D levels was noted in group IV (40-50years) with female preponderance followed by group III and group V. However in a study by Haimi M et al in his study stated Vitamin D levels were higher in infants as compared to older age groups. **[1]**

Groups elder than 65 years tend to show the lowest level of sunlight exposure, and aging leads to a reduce in vitamin D production. However, in the current study, the older adult population (aged 60-69 years) showed the higher level of vitamin D level among the age categories. The contradictory result might be because a high proportion of the older adult population was engaged outdoor activity.

A study by Zhang et al. studied among children aged 0-6 years old in a Chinese population found that serum 25(OH) D concentration was only 34.7% of the children were sufficient, 43.2% were insufficient, and 22.1% were deficient in the total population. **[8]** However in our study, 222 children age ranging from 0-12 years were evaluated and found that 67% were deficient, 13% was insufficient and only 20% of the children population showed vitamin D sufficiency. The mean serum 25 (OH) D level in deficient cases was 11.33±4.4 ng/ml. The mean serum 25(OH) D level of all subjects was 21.93±22.1ng/mL which was in the insufficient level of vitamin D. In a study by Roh YE, et al, they found that vitamin D deficiency was very common among children aged 6 to 12 years. There were 195 patients (59.1%) with vitamin D deficiency, and their mean serum 25(OH) D level was 14.86±3.20 ng/mL. The mean serum 25(OH) D level of all subjects was 19.83±7.39 ng/mL which was8 lower than the sufficient vitamin D concentration (≥20 ng/mL). **[2]** Lee et al. reported the mean serum level of 25(OH) D in 2,880 children and adolescents as 17.42±8.95 ng/mL. Another study reported that the pervasiveness of vitamin D deficiency in 1,212 children, which was between 4 and 15 years of age and was 58.6%.**[2]** These results are reliable with the findings of our study.

In our study 76% adolescent population was deficient and 3% was insufficient of vitamin D however in a study by Wang LK et al approximately, 81% and 15% of adolescents were vitamin D-deficient or vitamin D-insufficient, respectively. **[6]** Our finding is more akin to that reported from Saudi Arabia (95.6%), India (85%-98%), or Korea where only 2.3% of adolescents were found to be vitamin D-sufficient. **[6]**

In our study 35% population were office going and other 75% population was non office going which almost included similar percentage of male and female population in both the groups i.e. 40% male population and 60% female population. In office going population 83% male population had hypovitaminosis D (61% deficient and 22% insufficient) where as 72% female population had hypovitaminosis D (55% deficient and 17% insufficient) this was similar to study by Wang et al where Analysis of the distribution of serum 25(OH)D concentrations demonstrated a dominance of vitamin D insufficiency in both genders (52.4% females and 43.0%

males). 77% office going population had hypovitaminosis D including 57% deficiency and 20% insufficiency; this was similar to study by Wang LK et al who demonstrated a high prevalence of hypovitaminosis D which accounted to 61.9% (including deficiency and insufficiency) with 14.2% deficiency and 47.7% insufficiency among indoor office workers in subtropical Taiwan. **[6]** However in our study occupation i.e. office going and non office going had no correlation with vitamin D level. Both the groups had almost same percentage of Hypovitaminosis D, 76.4% office going had hypovitaminosis D where as 74% non office going had hypovitaminosis. Sufficiency was seen in only 23% office going population and 26.3% non office going population. Therefore in the current study occupation had no correlation with vitamin D level.

Our study revealed a high prevalence of vitamin D deficiency among children and young aged population. This is alarming, as infants, children, students and generally young adults having hypovitaminosis D during early adulthood may decline peak bone density and lead to an augmented risk of osteopenia or osteoporosis in life afterwards, as well as other long-term health impacts related with suboptimal vitamin D status.

Exposure to sunlight contributes up to 90%-95% of the vitamin D supply, while the number of foods naturally containing a significant quantity of vitamin D is very limited, except for some oily fish that is rarely consumed by people worldwide. Therefore to limit the hypovitaminosis D condition education of parents and adolescents on the safe amount of sun exposure, in addition to changes in the environment to aid exposure to sunlight, may manufacture the highest impact on vitamin D status. Studies have suggested to get the maximum vitamin D is between 10am to 3pm. **[10]** At this time the UVB rays are intense and body is also more efficient in making Vitamin D this time. **[10]** However, coverage of legs and arms for at least 15 min with sunlight twice per week has been reported to be satisfactory for adequate sun-induced cutaneous vitamin D synthesis.

CONCLUSION

In conclusion, a high prevalence of vitamin D deficiency was noted among infant, children, adolescents and elderly despite the abundant sunshine. Compared to females, males were more likely to have vitamin D insufficiency, and male gender appears to be a risk factor for vitamin D insufficiency. This may reflect strong sun avoidance behavior among all the age group. Occupation as such in this study had no direct role on vitamin D status. Therefore people should appropriately adjust their lifestyle, such as decreasing use of sun protection and increasing outdoor activities, as well as taking vitamin D supplements, to prevent vitamin D insufficiency.

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