

Prevalence of Vitamin D Deficiency among Female Students in Secondary Guidance School in Yazd City

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Abstract- Vitamin D is essential for growth and vitamin D deficiency is important issue in adolescent girls as they have a limited rapid growth period. This cross sectional study was done on 167 female students in secondary guidance school in 2006. Growth Parameters, taking supplementary vitamin D, using sunscreen creams and the type of housing and their avoidance from exposure to sunlight was recorded. Symptoms such as weakness, muscle pain, cramp and early fatigability were asked. 25-Hydroxyvitamin D was measured by RIA method, level less than 20ng/ml was considered as deficiency and less than 8ng/ml as sever deficiency. Study showed only 67 girl(40%) have normal vitamin D level, 60% suffered vitamin D deficiency (95% CI 52.3-67.5) and 21% out of them suffered sever deficiency (95% CI 14.8- 27.2). No correlation existed between vitamin D level and BMI in our students. There was a correlation between taking supplementary vitamin D and the serum level of 25-Hydroxyvitamin D ($P < 0.05$). People living in the houses with yards had higher vitamin D ($P < 0.05$). People who run away from the sun light exposure for any reason have lower vitamin D level significantly ($P < 0.0001$). There is no correlation between symptoms such as weakness, myalgia, cramp and vitamin D level ($P > 0.05$).

Present study showed that despite the fact that Yazd is a sunny city most of the days even in winter; prevalence of vitamin D deficiency among growing female is concerning and requires preventive interference.

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Introduction

Vitamin D commonly called sunshine vitamin is essential for the development, growth and maintenance of skeleton throughout the life (1).

The preliminary sources of vitamin D are exposure to the UVB and diet (2). Few foods naturally contains this vital vitamin (3, 4). Exposure to sunlight and production of active forms in skin is the main source of vitamin D. Vitamin D deficiency causes metabolic bone diseases in children and adults and sufficient level of it is required for the normal function of muscles. There is also evidence that vitamin D plays a role in preventing type I diabetes, hypertension, rheumatoid arthritis and multiple sclerosis (5, 3). Because of the high rate of bone growth and bone mineralization during the adolescence, more vitamin D is required in this period. (6). Vitamin D deficiency is prevalent in children in school age even in the sunny countries especially in winter and

girls are at increased risk of vitamin D deficiency (7). Vitamin D is taken from foods in the form of vitamin D₃ (animal foods) or vitamin D₂ (vegetable foods) or it is activated in the skin after sunlight exposure.

Few foods contain sufficient amounts of vitamin D, and enrichment of foods with vitamin D is not always reliable. So skin synthesis is the main source of vitamin D (9). During the exposure to sun light the ultraviolet ray (UVB) with the wave length of 290-315 nm is absorbed in the skin by 7-dehydro cholesterol to make pro vitamin D₃ which is naturally unstable and turns to vitamin D₃ quickly. The rate of vitamin D₃ synthesis in the skin depends on UVB that is absorbed by the skin (10). Vitamin D₃ and vitamin D₂ has the same biological effects (11). They are carried in to the liver and turned into the main form of vitamin D in foods that is 25-hydroxy vitamin D with half life of 2-3 weeks (12, 13). The serum level of 25-hydroxy vitamin D (25OH-Vit D) is the standard index for vitamin D status and depends on the

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amount of vitamin D received both from foods and synthesis in skin (8). Kidneys make active form of vitamin D, "1, 25-hydroxy vitamin D" which plays major role in the calcium and phosphorous homeostasis and all physiological effects of vitamin D depend on this active form. Its receptors exist not only in intestine and bones but also in many organs such as brain, heart, pancreas, activated lymphocytes, colon, gonads and breast (13, 14, 15). The main task of vitamin D is maintaining calcium homeostasis but it also has controlling effect on cell proliferation and differentiation. The active form of vitamin D is also a powerful modifier of immunity system and there is evidence that vitamin D increases immunity and prevents autoimmune diseases (17). Vitamin D also has a role in decreasing the risk of hypertension (18).

vitamin D production in skin can be limited by a number of factors including type of clothing (4-19), using sun screen (20), the content of skin melanin (20, 21), and the geographic region of living place. Above the latitude of 37° in autumn and winter sunshine angle is quite slanting, and a lot of UVB is absorbed by ozone layer. So, fewer vitamins D is produced by skin (5, 8, 10). Obesity is also a factor that increases the risk of vitamin D deficiency (22, 23). Glass windows absorb UVB and the light through the windows does not stimulate vitamin D synthesis in the skin (24). The clinical symptoms of severe vitamin D deficiency in growing children is rickets and hypocalcaemia which in fact, is the outer part of this iceberg. Subclinical vitamin D deficiency, the huge portion of the iceberg, not only prevents bone from maximal mineral accumulation but also is a risk factor of serious diseases including hypertension, diabetes, multiple sclerosis, colon, prostate and ovary cancer, osteoporosis and other health problems (10, 14, 25-27). Enough supply of vitamin D and calcium is necessary to maximize bone mineralization (28). Girls suffer from vitamin D deficiency globally while they would be mothers and will have stress of pregnancy and nursing. The crucial importance of this issue is better known when we realize that the period of maximum growth in girls are shorter, so they do not have enough time to compensate it in order to have healthy skeleton.

Patients and Methods

This cross sectional study was performed on 167 female students of secondary guidance schools in the city of Yazd during autumn and winter (2006). The cases were selected randomly in two phases: first, the names of all guidance female schools were taken from Yazd organization of education and five schools were chosen ran-

domly. Second, 167 students of grade II of these schools were randomly selected provided that they did not have any obvious symptom of endocrine kidney liver or skeleton diseases.

Afterward questionnaires were filled out by face-to-face interview. The questions were about their ages, taking supplementary vitamin D during last month, type of their accommodation house with yard or apartment, using sun screen occasionally or regularly symptoms such as weakness, fatigue, muscle pain or cramp. Their height and weight were measured by standard device (seca scale and cotton ruler). Then after taking permission from all participant 3 cc blood from peripheral veins taken, serums were separated quickly and frozen under 20 centigrade. Radioimmunoassay method was used to measure 25-hydroxy vitamin D level.

The protocol was approved by the institutional review board and local medical ethics committee. All data were analyzed statistically by spss.12 (SPSS inc., Chicago, IL).

Results

167 girl students between the ages of 12.5-15.5 with the mean and standard deviation of 13.3±0.7 were tested. They were all healthy without specific illness the mean and standard deviation of their weights was 48.6±11.6 kg within the range of 30-105 kg. Mean and standard deviation of their height was 155.4±6.8 cm. Within the limit of 132-171cm the mean and standard deviation of body mass index (BMI) was 19.99±3.96. 4.8% of these students were over weight and 4.8% were under weight. Five cases under studies had taken vitamin D (Vit D) during the previous month that is 3% of the subjects under study. 38 of them (22.8%) used sun screen every day and only 7 (4.2%) of them lived in apartment. The examination of the Vit D level of the subjects showed that only 67 or 40.1% of them had normal level of vitamin D and 59.9% showed Vit D deficiency (CI 95%, 52/3-67.5). 21% out of them (CI 95%, 14.8- 27.2) suffered from severe vitamin D deficiency (Table 1).

Table 1. Distribution of vitamin D level in secondary school girl in Yazd (No: 167)

Vit D level	Number(percent)	Accumulative percentage
Less than 8 ng/ml	35(%21)	21%
8-20 ng/ml	65(% 39)	60%
Over 20ng/ml	67(%40)	40%

Our study could not show correlation of BMI and level of Vit D ($P>0.05$) and according to percentage of weight and vit D level there was not relation between weight and vit D level. There were statically significant correlation between vitamin supplement and type of accommodation with vit D level. ($P>0.05$)

Those girl who avoided sun exposure for any reason had lower level of vit D ($P<0.001$) (Table 2). Although 65% of studied girl suffered from some symptoms like myalgia, muscle cramps, early fatigability, but we could not show any relation between these non specific symptoms and level of vit D ($P<0.05$). Thirty-eight girls used sunscreen every day and 55 use it irregularly. No relation was found between sunscreen and vitamin D level ($P<0.05$).

Discussion

As a steroid hormone vitamin D has a significant role in health of bone and prevention of chronic diseases (33). Especially in countries where food stuffs are not enriched with vitamin D, girls are at risk to vitamin D deficiency (34, 35). Although the acute and severe forms of vitamin D deficiency are uncommon, it seems that the sub clinical form is still prevalent. Despite the fact that this vitamin is widely available and is inexpensive, but various social and cultural factors including modern life and the phobia of harmful effects of sun on skin, stop girls to take advantage of it. Considering the fact that Yazd is located in a desert in the latitude of 31.5° (with features similar to other central cities in Iran and Middle East), it is sunny most of the days and living in apartments is not so common, people can use their yards and walk to school to expose to the sunlight. If in this situation vitamin D deficiency is high it is most probable that it is prevalent in other cities too. Knowing all these facts reveals the significance of this survey in Yazd. This study showed that 60% of our girls have vitamin D deficiency with the serum level of 25OH Vit D $<20\text{ng/ml}$ and 20% out of them suffer from severe deficiency. The result of this study is similar to that of Moussavi et al. in Isfahan in 2004 (39), in which the total incidence of

vitamin D in both males and females has been 46%, and 14.5% of girl suffered from severe deficiency. In the above mentioned study, the cut off point for secondary hyper parathyroid was under 32ng/ml of vit D, according to this level 95.2% of female student in Isfahan have lower vitamin D level (36) while 63.5% of the subjects in our study have vitamin D level less than 32ng/ml . Other studies in Tehran were done by Hashemi poor et al. and Larijani et al. which separately showed the incidence of vit D deficiency in child bearing age women is 60 to 80 percent and factors such as life style and air pollution are suggested to be the responsible factors (37, 38). A study in Lebanon, where there is a similar type of wearing, indicated that vitamin D deficiency in healthy children at the age of 10 to 16 is 65% (25 OH Vit D $<20\text{ng/ml}$) and gets to 40% during the summer (7). The differences brought about by seasons is more evident in Chinese girls living in Beijing as the deficiency in winter is 45% while it is 7% during summer (39). Our study was done in winter. However, It seems that there is no significant difference in winter and summer in this regard since students are on summer holiday and females usually go out after sunset in summer, besides, there are almost not many differences between the amount of sunny days in summer and winter in Yazd. To confirm this, we can refer to the study of Mirsaied Ghazi and colleagues in Tehran in which there has been no difference between the vitamin D level of women in summer and winter (40).

Another study in Turkey indicated the season effect so as in winter 60% and in summer 25% of girls belonging to higher socioeconomic class suffered from vitamin D deficiency. However, this was less prominent in urban areas (41, 42). In cases that interfering plans is going to be done it should be considered that if our urban girls are also suffering in such extent or not. A recent study showed a significant correlation between taking supplementary vitamin D in the previous month, so considering the study of Dahifar et al. in Tehran and other studies, giving supplementary vitamin D to the students should be considered as a long-term preventive strategy (43, 44).

Table 2. Distribution of vit D level according to answer of sun avoidance question in secondary school girl in Yazd

Run away from sun	Vit D level		Sum
	$<20\text{ng/ml}$	$>20\text{ng/ml}$	
Yes	91(%91)	45(%67)	137(%81)
No	9(%9)	22(%33)	31(%19)
Total	100	67	167

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Even though many studies showed a reversed correlation between BMI and vitamin D, several studies in Iran didn't get the same result (23, 45), or found a linear correlation (46). It seems that Iranian life styles and regional environments influence the serum level of vitamin D more than BMI (36, 37).

Parameters such as weight and vitamin D level in malnourished states were also examined. We did not find any correlation between malnutrition and vitamin D level similar to what Moussavi et al. reported (36).

The level of vitamin D in students living in houses with yards is significantly more than that of those students living in apartments. The reason may be the exposure to the sunshine in their yards or their life style. Odds ratio for deficiency in people living in apartments compared to living in houses was 2 (CI 95%, 1.3-2.9, $P < 0.05$).

Another point considered in this study was people's avoidance of sunshine. Since the amount of exposure to the sun is not simply measured and requires costly instrument or inaccurate questionnaire, the students were asked whether they tend to be exposed to the sun light or avoid the sunshine for any reason including the fear that their skins get darkened. The results indicated that vitamin D deficiency in people who simply said avoid from sunshine is significantly more than others ($P = 0.0001$) using odds ratio made it clear that the risk of having vitamin D serum level less than 20 ng/ml among people avoiding sunlight is about five times than others (CI 95%, 3.4-6.5, $P < 0.05$). We didn't find similar studies in this regard, in majority of study time of sun exposure quantitatively measured as hour of exposure (36) but we asked only a non specific simple qualitative question, which is convenient but has a strong prediction which needs to confirm by future study. Among students in the survey done by Sullivan and partners in Maine, it was reported that 48% of white girls have vitamin deficiency at the end of winter and 17% out of them kept having this deficiency in summer according to this study the latest group avoided sun light or use sunscreen cream (8) so it seems that a large number of our girls also suffers from vitamin D deficiency in summer because of the similar sun avoidance behavior. In our study 22.8% of students used sun screen regularly but there was no correlation between using sun screen and vitamin D level. It is probably because of the fact that they did not use sun screen properly or the people use sun screen did not avoid sun light while they may not use these creams sufficiently.

In this study the correlation between weakness fatigue, muscle cramps and vitamin D level was exam-

ined. There was no correlation between any one of them and vitamin D level. We also compared the serum level of vitamin D of those people who had at least one of these symptoms and that of those who had none of these symptoms and observed no significant correlation. The reason is not known exactly; perhaps the subjects under studies could not perceive the exact definition of these terms. Other disorders such as lack of activity, improper chairs or classroom condition may also mimic these symptoms. In conclusion, although several studies before have shown low level of vit D in Iranian girls, but this study which is carried out in a city with more sunny days than other city of Iran has an important message that in other cities with less sunny days, majority of growing girls are susceptible to sub clinical vit D deficiency. Therefore, preventive strategies parallel to regular milk supply is seriously recommended, and simple question about sun avoidance may identify the high risk group.

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