

Status of vitamin D deficiency among adolescent girls of Rajasthan and its association with fasting glucose levels

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ABSTRACT

Vitamin D is very important for adolescent as well as children. Because of its role in calcium absorption it is required for bone development. Vitamin D deficiency has become quite common now days in almost all the countries of the world and has become a serious public health problem among all the age groups. As vitamin D also has been found to play an essential role in diabetes mellitus hence, no doubt, it is very important to have knowledge pertaining to Vitamin- D in maintaining fasting glucose level. However, very less data is present on vitamin D deficiency and its association with fasting glucose level among adolescent girls. The basic endeavor was to assess the spread and effects of vitamin D deficiency and its link with fasting glucose level among adolescent girls having age between 12-15 years in Rajasthan. A total number of 280 girls were randomly selected having age between 12-15 years. Serum fasting glucose level and serum 25(OH) D3 level of adolescent girls was evaluated. 91.7 of adolescent girls were found were having vitamin D deficiency as per serum 25(OH) D levels less than 12 ng/ml and 75.83±13.50 mean serum fasting glucose. A high prevalence of vitamin D deficiency was seen among adolescent girls but there was no significant relationship between serum fasting glucose and vitamin D deficiency.

Keywords: Vitamin D deficiency, prevalence, 25(OH) D, fasting glucose, Adolescent girls

INTRODUCTION

Vitamin D is a fat soluble vitamin which is also called Sunshine Vitamin. It has various functions in human body; not only it is important for absorbing calcium but is also plays role in maintaining many physiological and pathological processes [1]. Now days it has been linked in maintaining various chronic diseases like diabetes, cardiovascular diseases, metabolic syndromes, autoimmune diseases, infections and to risk of developing various cancers [2]. Vitamin D deficiency is serious health issue these days as in tropical countries where there is ample amount of sunlight but still maximum population is being seen as vitamin D deficient. There is no confirmed data that states the relationship between development of Diabetes and Vitamin D. There are still many cross-sectional and longitudinal studies that state the inverse linkage between vitamin D levels and diabetes [3]. There are studies that suggest the association of vitamin D deficiency and type 1 diabetes among children [4]. Low 25(OH) D3 levels are associated with low bone mineral density as it plays role in calcium homeostasis, yet also plays major role in secretion of insulin and maintaining glucose homeostasis [5-7]. Vitamin D receptors (VDR) are also present in pancreatic cells. Vitamin D binding proteins and calcium play a pivotal role in insulin secretion [6, 8]. Additionally vitamin D is seen to inhibit the rennin-angiotensin system action which results in secretion of insulin in body [9]. Fasting blood sugar levels are correlated with vitamin D levels among adults and children with type 1 diabetics [10]. Researchers suggest various possibilities of not having sufficient amount of vitamin D among children even after living in tropical country like India which are poor lifestyle, indoor activities, less outdoor activities in schools and home, decreased sun exposure etc [11]. However, there are still researches ongoing; therefore it is of utmost importance to conduct screening for vitamin D levels as soon as possible and also conduct screening for fasting blood sugar levels in order to decrease the risk of further development of diseases among adolescent. The present study was planned to assess the prevalence of vitamin D deficiency among adolescent girls of Banasthali University Rajasthan and to identify the association between vitamin D deficiency and fasting glucose level.

METHODOLOGY

Subject selection

The present study was conducted in the area of Banasthali University (Rajasthan). For the study 280 adolescent girls studying in senior secondary school were randomly selected age between 12 to 15 years.

Data collection

Information about age, family type and family status was obtained from all subjects with the help of a questionnaire. The girls having maximum attendance and the children who brought a signed consent from the parents were included in the study. Subjects having any long term medication and children who were consuming Vitamin D via supplements were excluded from the study. Overnight fasting blood samples were collected for the biochemical test from all the study individuals. 5ml of blood was collected from each adolescent girl. The blood was centrifuged within one hour to separate serum.

Analysis

The serum was carried out by conducting the process of centrifugation at 2500 rpm for 7 min within 1h after collection. Serum samples were stored at -20 degree Celsius till the time biochemical analysis was done. Blood glucose level was analyzed within 3h of collection. The analysis of serum glucose level was done by using ready to use reagent kit of Randox and measured using auto-analyzer (Randox laboratories ltd. 55 Diamond Road, Crumlin, county Antrim, BT 29 4QY, United Kingdom). The assessment of serum 25(OH) D was conducted through LIASON 25(OH) D3 TOTAL assay using chemiluminescent immunoassay (chemiluminescence).

Cut-off values for vitamin D status

The Indian pediatrics classification was used for the determination of vitamin D deficiency among adolescent girls. Serum 25(OH) D3 level greater than 20ng/ml were considered having sufficient level and between 12-20 ng/ml as insufficient and <12ng/ml as deficient [12].

Statistical analysis

For conducting the statistical analysis of the data (IBM SPSS statistics) Statistical Package for Social Sciences (SPSS) version 20.0 was utilized. Prevalence was calculated in percentage. Data were expressed as mean \pm standard deviation. To find the correlation between vitamin D levels and fasting glucose level Pearson's correlation coefficient was used. Statistical significance was considered as p value less than 0.05 ($p < 0.05$).

Results

The total number of 280 adolescent girls was included in the study having age between 12-15 years. The mean age of adolescent girls was 13.36 ± 0.64 years. 90.8% of adolescent girls were from upper middle income group and rest of the girls belonged to lower income group. According to the cut offs of serum 25(OH) D3 levels the adolescent girls were classified and most of them were found to have insufficient level. The prevalence of vitamin D deficiency was noted 93.94% among the adolescent girls. The mean serum 25(OH) D3 level of adolescent girls was 16.32 ± 1.82 ng/ml and mean fasting glucose level was 76.83 ± 13.50 mg/ml. Adolescent girls had low mean fasting glucose level and almost had insufficient level of vitamin D (table 1). According to correlation calculated between fasting blood glucose level and serum 25(OH) D₃ level there was no significant correlation observed (table 1 and figure no 1).

1. Mean serum fasting glucose and serum 25(OH) D3 levels of adolescent girls

	(Mean±SD)	r value	P value
Fasting glucose level (mg/dl)	76.83±13.50	0.078^{ns}	0.356
Serum 25(OH)D3 (ng/ml)	16.32±1.82		

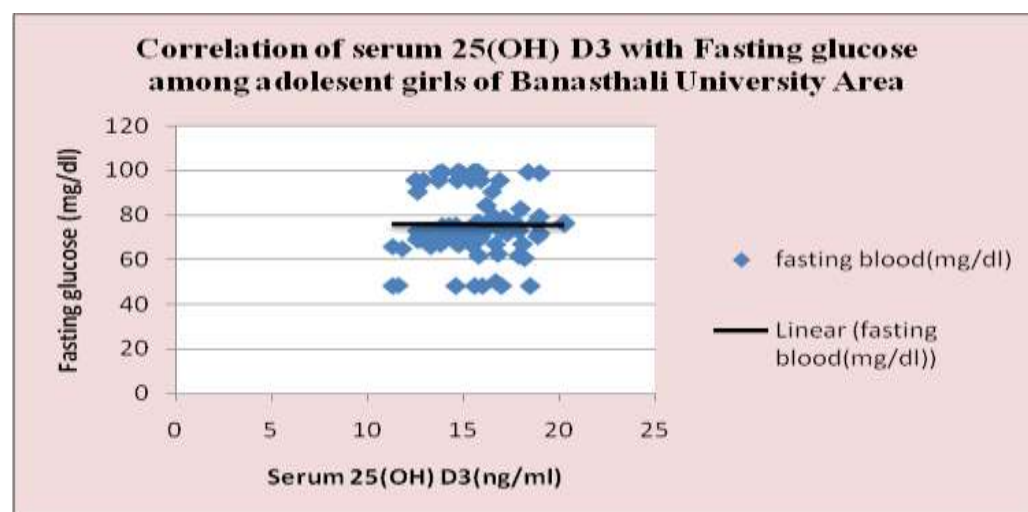


Figure 1 Correlation of serum 25(OH) D3 with Fasting Glucose levels

Discussion

The deficiency of Vitamin D is now being confirmed as pandemic all over the world and even in the tropical countries like India. The main cause is less outdoor activities, use of sunscreen and poor dietary and lifestyle habits [13]. In the present study insufficient level of vitamin D was noted in maximum study population. It was found that 90.24% of adolescent girls had insufficient level of vitamin D and 6.8% adolescent girls were deficient. Rajasthan being one of the sunniest states of India yet still the adolescent girls had lower levels of sunshine vitamin. It could be due to less exposure to sun. An earlier study also states that children living in jaipur had 87.50% of vitamin D deficiency [14] And in an another study conducted among adult and old age (50 – 82 years) reported 74% of sunshine vitamin deficiency in the southern area of Rajasthan and also states that women were more deficient as compare to males [15]. Many studies which were conducted in different regions of India among adolescent girls and boys have reported higher prevalence of vitamin D. Some of them are- 70% prevalence among school girls[16], 90.8% prevalence in school going girls[17], 93.7% prevalence among school going girls[18], 48.3% & 33.8% prevalence among children and adolescent girls[19], 94.8% among adolescent[20], 92.3% among school children[21].

The mean fasting glucose level of adolescent girls was low; this could be due to poor dietary habits and skipping meals by the children. When levels of serum vitamin D and fasting glucose levels were compared there was no significant correlation found. But in many studies it was found that blood glucose levels were associated to vitamin D status. Recently a study done among adolescents and children suggest that vitamin D levels of children suffering from type 1 diabetes were significantly low and vitamin D levels impact on glycemic homeostasis hence vitamin D treatment can be considered as an additional therapy for these children [22]. Also another study did on Asian Indian women states that Lower levels of vitamin D were associated with higher value of blood glucose [23]. Surprisingly, adolescent girls living in the Banasthali University area had lower glucose level and almost had insufficient level of vitamin D, therefore it can be assumed through our analysis that low serum 25(OH)D3 levels are associated with inappropriate level of

blood glucose values among adolescent girls or low fasting glucose level was due to inadequate level of vitamin D among adolescent girls of this region.

Conclusion

Sunshine vitamin deficiency is highly prevalent across India. Childhood as well as adolescence is a period of bone and skeletal development and therefore it becomes important to maintain sufficient level of vitamin D. These girls which are deficient may perhaps have a higher risk for development of osteoporosis and other chronic disease and complications in future life. Although in the present study no correlation was found among the vitamin D levels and fasting glucose level but there are many studies suggesting the relation between serum vitamin D levels and fasting glucose level among all age groups. On the contrary, adolescent girls living in the Banasthali University area had low glucose level and almost had insufficient level of vitamin D, therefore it can be assumed that lower serum 25(OH)D3 level were because of inappropriate level of blood glucose values or vice-versa among adolescent girls. Our data indicate that maximum girls in Banasthali university region have insufficient and deficient vitamin D serum levels. The reason could be due to the inadequate exposure to sunlight because of various cultural and societal restrictions, due to vegetarian diet insufficient dietary intake of vitamin D, lesser intake of vitamin D fortified food and milk adulteration. It is important that Parents of these adolescent girls should be taught about Vitamin D and its importance and how its deficiency can lead to fatal consequences in future.

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