Original Research

EFFECT OF VITAMIN – D SUPPLEMENTATION ON SERUM VITAMIN D AND CALCIUM LEVELS IN URBAN AND RURAL PREGNANT WOMEN

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ABSTRACT

Background: A normal level of vitamin D along with serum calcium levels during pregnancy is very important for foetal skeletal development, tooth enamel formation and perhaps general foetal growth and development. The present study aim is to find out the serum calcium levels in pregnant women based on their living area during the prenatal period. **Materials & methods:** It is a prospective study, done in 100 pregnant women who were allocated randomly into two groups based on living location. After giving 6000 IU of vitamin– D intervention, the calcium levels are measured at the end of 3 months and the variables were obtained before and after the intervention. **Results:** The mean difference of serum calcium levels 9.49±0.05, 8.97±0.025 in rural, urban pregnant women respectively after the vitamin - D supplementation [p<0.0001] after 3 months. **Conclusion:** Early intervention at reproductive age, fifth and seventh month of gestational age, regular screening and including in antenatal program, high dose of vitamin - D supplementation would be effective to prevent deficiency and improve the vitamin status.

Keywords: Hypocalcemia, Pregnancy, Rural women, Urban women, Serum calcium

INTRODUCTION

The vitamin D is considered as a vitamin in previous days and now a days it is considered as a hormone based on its vast actions on the human body and it is in two forms vitamin D2 / ergocalciferol and vitamin D3 / cholecalciferol and both has prohormone function[1]. During pregnancy the maternal vitamin D deficiency affects foetus normal development and globally it is considered as a major public health issue[2]. The risk factors for vitamin D deficiency are ethnicity, full skin covering, and excess usage of sun protectors, obesity, low dietary intake and smoking.

The development of the foetus depends on the maternal supply of vitamin D, calcium, phosphorus and other minerals which are transferred through the placenta. For this previous studies evidenced that maternal and cord blood vitamin D levels are highly correlated in their studies[3]. Previous studies found that vitamin D deficiency is high among adolescents and women of reproductive age[4]. The vitamin D deficiency has a major negative role on foetal development so estimation of vitamin D levels on maternal and perinatal periods supports the importance of vitamin D screening and treatment during pregnancy. Many people think that vitamin D deficiency is rare in countries with abundant sun light and it is disproved in many studies and it is evidenced with India has high prevalence of vitamin D deficiency [5-7].

The daily intake of the vitamin D is low both in urban and rural population of India and is not in line with the recommended daily/dietary allowances [RDA] issued by Indian Council of Medical Research which directly effects the serum calcium levels . The present supplementation recommendations are inadequate to ensure vitamin D sufficiency in pregnant and lactating women. Vitamin D deficiency is prevalent in both rural and urban population due to environmental difference, life style and nutritional balance and urban population is more vulnerable to vitamin D deficiency. The present study is undertaken to compare to the Vitamin D and serum calcium levels between urban and rural mothers.

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MATERIALS & METHODS

Study design & study group: A prospective study was carried out on 100 pregnant women aged between 20-35 years. The study protocol was reviewed and approved by the Institutional Ethics committee of SVS Medical College & Hospital, and an approval number [IEC approval No. 02/2019] was obtained before starting the study.

Inclusion criteria: The participants were randomly selected who got pregnancy and gestation age between 1st trimester to 3rd trimester were recruited and allocated into urban group [50] and rural group [50] based on their living location.

Exclusion criteria: Pregnant women with endocrine disorders, hypertension, diabetes mellitus, a recent history of major surgeries and trauma were excluded from the study.

The study protocol's benefits were explained to all participants and clarified their willingness to withdraw from the study. A written informed consent document was obtained from all participants as well as from their guardians and adopted the recommendations of the Declaration of Helsinki guidelines [1975] and later amendments.

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All study group participants were interviewed about their pregnancy profile. As they have hypocalcemia, 6000 IU of Vitamin D3 was intravenously infused for three months. The dosage was adopted the recommendations and policies of vitamin D supplementation. No adverse effects were reported during the interventional period. Trained nurses carried out all the interventional procedures under the supervision of the fraternity from the gynecology department. The effectiveness of Vitamin D supplementation on calcium levels are measured O-Cresolpthale in complex one [OCPC] after three months in both the groups. Later Vitamin D levels were also measured using the CLIA method.

STATISTICAL ANALYSIS

The data sets were analyzed using R software and represented as Mean ± SE values. The normality of data was tested using the Smirnov-Kolmogorov test. As the data sets were skewed, all non-parametric tests were implemented to compare the differences in calcium levels between the two groups.

Table-1: Comparison of the effectiveness of Vit - D supplementation on serum calcium levels.

Values are mean ± SE: n = 50;

Calcium = serum calcium [mg/dL].

S. No.	Comparisons	Groups	Calcium	Vitamin D
1	Rural [Vitamin D supp]	Before	8.16 + 0.015	21.1 + 0.7
	Urban [Vitamin D supp]	Before	7.86 + 0.008	22.4 + 0.7
	Rural [Vitamin D supp]	After	9.49 + 0.005	27.0 + 0.9
	Urban [Vitamin D supp]	After	8.97 + 0.025	30.6 + 0.7
2	Significance among groups [Control and Vit D Supp]		F = 307.753 P < 0.001	F = 4.477 P = 0.037
	Significance among tests [Before and After]		F = 162.933 P < 0.001	F = 187.723 P < 0.001
	Significance in the interaction [groups X tests]		F = 0.618 P = 0.433	F = 9.227 P = 0.003
3	Significance between Before [Control and Vit D Supp]		t = 12.174 P < 0.001	t = 0.256 P = 0.798
	Significance between After [Control and Vit D Supp]		t = 13.258 P < 0.001	t = 3.375 P < 0.001
4	Significance within Control [Before and After]		t = 8.554 P < 0.001	t = 7.615 P < 0.001
	Significance within Vit D Supp [Before and After]		t = 9.489 P < 0.001	t = 11.722 P < 0.001

Vitamin D = serum vitamin D [IU/L].

The 'F' and 'P' values are by two-way RM ANOVA with Bonferroni 't' test.

RESULTS

Table - 2 : Serum calcium levels in rural and urban pregnant women

Group	Before [Mean±SE]	After [Mean±SE]	P – value
Rural [n=50]	8.16±0.015	9.49±0.005	<0.0001
Urban [n=50]	7.86±0.008	8.97±0.025	<0.0001

The mean of Serum calcium levels of rural population before and after Vitamin D supplementation are 8.16 and 9.49. the urban population before and after vitamin D supplementation are 7.86, and 8.97 mg/dL respectively. Two way RM ANOVA revealed significant difference among the groups [before and after; within group comparison], and group X test interaction [P = 0.433, and P < 0.001 respectively]. The rural before and urban before Vit D supplementation did not show statistical significance [P = 0.798]. The rural and urban after vitamin D supplementation after showed statistical significance [P < 0.001]. The rural before and after showed statistical significance [P < 0.001]. The vitamin D supplementation before and after also showed statistical significance [P < 0.001].

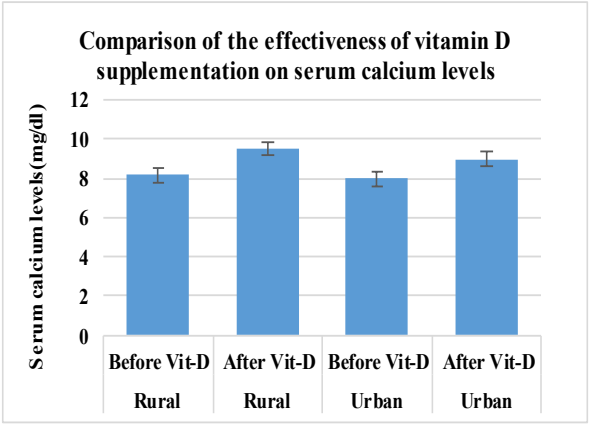

Fig –1: Comparison of the effectiveness of vitamin D supplementation on serum calcium levels

The values are mean + SE [n=50]

Two way analysis of variance with Bonferroni 't' test .

Serum calcium levels in Rural population before and after Vitamin D supplementation - 8.18 + 0.05; 9.07 + 0.08

Serum calcium levels in Urban population before and after Vitamin D supplementation - 9.07 + 0.08;10.52 + 0.12

a. Significantly increased from the respective control group [between groups comparison].
b. Significantly increased from the respective before group [within groups comparison].

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Table-3: Vitamin - D levels in rural and urban pregnant women

Group	Before [Mean±SE]	After [Mean±SE]	P – value
Rural [n=50]	21.1 + 0.7	29.8 + 0.9	<0.0001
Urban [n=50]	22.4 + 0.7	28.6 + 0.7	<0.0001

The mean of vitamin D level of rural before Vitamin D, urban before vitamin D supplementation group, rural before Vitamin D and urban after vitamin D supplmetation group are 21.1, 22.4, 29.8 and 28.6mg/dL respectively. Two way RM ANOVA revealed significant difference among the groups (before and after; within group comparison), and group X test interaction [P = 0.037, P < 0.001 and P = 0.003 respectively]. The rural before and urban before Vit D supplementation did not show statistical significance [P = 0.798]. The rural and urban after vitamin D supplementation after showed statistical significance [P < 0.001]. The control before and after showed statistical significance [P < 0.001]. The vitamin D supplementation before and after also showed statistical significance [P < 0.001]. The rural before and after showed statistical significance [P < 0.001]. The vitamin D supplementation before and after also showed statistical significance [P < 0.001].

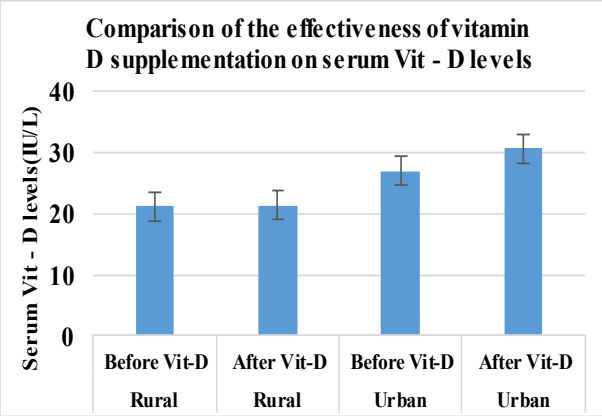

Fig –2: Comparison of the effectiveness of vitamin D supplementation on serum calcium levels

The values are mean + SE [n=50]

Two way analysis of variance with Bonferroni 't' test .

Serum calcium levels in Rural population before and after Vitamin D supplementation - 21.1 + 0.7;29.8 + 0.9

Serum calcium levels in Urban population before and after Vitamin D supplementation - 22.4 + 0.7;28.6 + 0.7

a. Significantly increased from the respective control group [between groups comparison].
b. Significantly increased from the respective before group [within groups comparison].

DISCUSSION

In most of developing countries due to insufficient intake, Vitamin D deficiency is most widely observed in pregnant mothers. Even in tropical country like India it is prevalent in both rural and urban people of all age groups [6,7,11]. Vitamin –D depends on geographical location, poor living conditions, economic status and cultural factors [14,15]. Even people living in urban areas in developed countries who are in favour of living indoors, cultural factors were most of body is wrapped, dark skin people, improper ventilation too reported to suffer with poor vitamin D[16]. Immediate intervention is considered as according to current studies a population prevalence > 20% include under public health problem [17].

Earlier studies by Holmes et al, Kumar KJ et. al., Sachan et al and Marwaha et al found vitamin D concentrations were 80% - 96.3% lower in pregnant women compared to non-pregnant women[5,7,18]. Rural adult women have significantly higher Vitamin –D level than urban women [13]. Pregnant multiparous women along with inadequate Vitamin D are at high risk [19]. These findings are in line with present study as two- thirds of pregnant women belong to low educated families and socio-economic ground, most of them were housewives.

Present study observed the co-relation between Vitamin – D Supplementation On Serum Calcium Levels In Urban And Rural Pregnant Women. The prevalence of vitamin D deficiency among pregnant women was irrespective of infection. The study was in line with previous studies[20]. Association between parity and vitamin D deficiency revealed nulliparous pregnant women were at high risk than multiparous pregnant women furthermore the risk was high in women in first trimester than women in second trimester of pregnancy. It might be due to hormonal and metabolic changes that occur during pregnancy. The skin colour too play a vital role, dark skin women have deficiency of vitamin D level when compared to women in western countries. These findings are in line with the present study[21,22]. Present study observed that pregnant Muslim women were found to have vitamin D deficiency more than others it may be due to religious and cultural activity these findings were similar to previous studies conducted in various Islamic countries[23,24].

Vit D causes stimulation of intestinal calcium and Phosphorus absorption, renal tubular calcium reabsorption and calcium mobilization from bone is done by activation of Vitamin D Receptor by 1,25[OH]2D which is helping in elevating serum calcium levels during pregnancy.

In the present prospective study, it was found pregnant women with normal vitamin D level which directly correlates with serum calcium levels had lower incidence of preeclampsia than others who had low level of vitamin D levels, this study was in line with other studies[25]. Active form of vitamin D can be synthesized from the inactive precursor due to presence of 1-hydroxylase in human brain. This indicates vitamin D also play key role in development of brain and neuropsychological development of children. This observation is similar with earlier studies [26].

CONCLUSION

Early intervention at reproductive age, fifth and seventh month of gestational age, regular screening and including

in antenatal program, high dose of vitamin D supplementation would be effective to prevent deficiency and improve the vitamin status. Vitamin D depends on skin pigmentation, duration of sun exposure and body surface area exposed, cultural, occupational economic factors. So, awareness and knowledge of nutrition, fortified foods should be given considering long term health problems. Interventional studies are needed to know the effect of vitamin D on preeclampsia and development of brain.

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Sources of funding: nil

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