International Research Journal of Medical Sciences _____ ISSN 2320 –7353
Vol. **2(9),** 1-8, September **(2014)** *Int. Res. J. Medical Sci.*

Effectiveness of Diet Therapy and sun Exposure in Elevation of Vitamin–D Level

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Available online at: www.isca.in, www.isca.me
Received 4th August 2014, revised 9th September 2014, accepted 18th September 2014

Abstract

The fat soluble Vitamin D is recognized as the sunshine vitamin and it is considered more of a hormone than a Vitamin. The increasing prevalence of vitamin D deficiency in different parts of India in all age groups including neonates, school children, pregnant/lactating women, adult males and females residing in rural and urban India. The daily requirements of Vitamin D of body cannot be fulfilled by only food intake as the presence of Vitamin D in daily Indian food is very less in amount. But, the human body can synthesize Vitamin-D from sunlight exposure. This study was carried out in Kolkata to identify and address the role of Sunlight exposure in elevation of Vitamin-D level as well as the role of demographic factors like age, sex, caste and socio economic scale for the same. In this study 100 samples were taken who were suffering from Hypovitaminosis D (Lack of Vitamin D). Among them other 50 were treated as the case group (were in recommended diet and sun light exposure) and rest of the 50 were treated as the control group (without any suggestion).After 3 months when again blood test were done to measure the 25-hydroxy vitamin D level which is the most accurate way to measure how much vitamin D is in our body, it was found that samples with diet and sunlight exposure improved significantly to those whom were not given any suggestion. The normal range is 30.0 to 74.0 nanograms per millilitre (ng/ml).The test is also alternatively known as 25-OH vitamin D test / Calcidiol / 25-hydroxycholecalciferol test. After the study, it is also found that maximum number of women staying at home as well as the geriatric subjects with low sun exposure suffer from bone ache, tingling effect at extremities due to low Vitamin D level. After the research work was completed it had been found that according to Statistical analysis, there is a correlation between the diet and sunlight exposure with the and improvement of Vitamin D level. Data was were analyzed using SPSS (version 18). One way ANOVA was used to study the factors affecting elevation of Vitamin-D level. The factors (Omit one full stop)which were significantly associated with elevation of Vitamin-D level were age ($p<0.05$), sex ($p<0.05$), caste ($p<0.05$) and Socio economic level ($p<0.05$).

Keywords: Bone mineral health, hypovitaminosis D (Lack of Vitamin D), 25-hydroxy vitamin D/25-OH vitamin D test / Calcidiol / 25-hydroxycholecalciferol, Sun light exposure, Diet.

Introduction

Vitamin D is a collective term for a group of compounds with antirachitic activity and includes ergocalciferol, cholecalciferol and Dihydrotachysterols, together with their biologically active metabolites. Ergosterol and 7-Dehydropcholesterol is the pro vitamins of Vitamin-D. Ergosterols derived from plants, was originally isolated from ergot, while 7-Dehydropcholesterol is found in the skin. When irradiated with ultra violet rays, these two become active antirachitic substances. On the other hand, Calciferol helps to calcify bone. When ergosterol is exposed to ultra violet rays in the form of Sun light Calciferol is produced. Most humans depend on sun exposure to satisfy their requirements for vitamin D because Very few foods naturally contain vitamin D. Oily fish such as salmon, mackerel, and sardines are good sources of vitamin D_3, as are irradiated mushrooms. Although egg yolks are reported to contain vitamin D, amounts are highly variable (usually no more than 50 IU per yolk), and the cholesterol content of egg yolks makes this a poor source of vitamin D. Cod liver oil is an excellent source of vitamin D_3. Very few foods are fortified with vitamin D. Fortified foods include milk orange juice (100 IU per 8-ounce serving) and other juice products, and some breads and cereals[1]. Solar ultraviolet B photons are absorbed by 7-dehydrocholesterol in the skin, leading to its transformation to previtamin D_3, which is rapidly converted to vitamin D_3. Season, latitude, time of day, skin pigmentation, aging, sunscreen use, and glass all influence the cutaneous production of vitamin D_3. During exposure to sunlight, the ultra violet rays penetrate the cuteneous layer where they convert 7-dehydropcholesterol to procholecalciferol, which later on produce Cholecalciferol. The capacity of skin to synthesize Vitamin-D in the elderly is less than that in the young. So, Vitamin-D deficiency is very common in elderly people. The deficiency of Vitamin-D also varies with skin pigmentation by means of body complexion, aging and Latitude. Vitamin-D deficiency occurs with inadequate exposure to sunlight, inadequate intake of foods, drugs that antagonize Vitamin-D action and altered metabolism due to damaged liver and kidneys & obesity[2-5]. Vitamin-D deficiency exacerbates rickets in children, osteomalacia in adults due to increased demand of

calcium and Vitamin-D during pregnancy or deficient intake in old age leads to osteoporosis[6-12].

Aims and Objectives: i. To study the effectiveness of Diet and Sun exposure in elevation of Vitamin-D level. ii. To identify the Demographical determinant which affect the elevation of Vitamin –D level after having the proper diet therapy and Sun exposure.

Methodology

A community based cross sectional study was conducted in urban area. The patients who were either admitted with osteoarthritis or osteoporosis or came to the hospital as an outdoor patient to treat same problems were included as subjects. (Omit the highlighted portion). The verbal consent was taken from all the subjects. Those who had renal problems, liver problems, hypothyroid, pregnancy tuberculosis and seriously ill were excluded from the study. The data regarding socio-demographic factors like age, gender, caste, socio economic status were collected. To measure the change in the Vitamin D level, the before study and 3 months after study reports of 1,25-Dihydroxy vitamin D levels were taken. The data thus obtained was compiled and analyzed using SPSS (version 18). One Way ANOVA was used to study the effectiveness of diet therapy and sun exposure in elevation of Vitamin D. P value of less than 0.05 was considered statistically significant.

Table-1
Study on the mean increase in vitamin-D level in case group and control group

Case group			Control group				
No. of pt.	**% Among whole population**	**Mean increase in vit-D level after study**	**No. of pt.**	**% among whole population**	**Mean Increase in Vit-D level after study**	**F ratio**	**P value**
50	**50%**	**2. 42**	**50**	**50%**	**0.82**	**88.0639**	**0.1959**

Table-2
Analytical study of vitamin-D level depending upon demographic factors

Demographic factor		Case group			Control group				
		No. of pt.	**% among whole population**	**Mean increase in vit-D level after study**	**No. of pt.**	**% among whole population**	**Mean Increase in Vit-D level After study**	**F ratio**	**P value**
Age (yrs)	5-15	10	10%	3.71	10	10%	1.14	102.2606	0.1668
	16-45	18	18%	2.22	18	18%	1.01	19.9013	0.1844
	46-59	8	8%	2.04	8	8%	0.70	12.5557	0.1691
	60 and above	14	14%	1.98	14	14%	0.63	55.3550	0.1781
Sex	Female	25	25%	1.88	25	25%	0.73	39.3040	0.1894
	Male	25	25%	2.96	25	25%	1.04	67.6791	0.1894
Caste	Hindu Female	22	22%	1.90	22	22%	0.77	37.1077	0.1875
	Muslim female	3	3%	1.73	3	3%	0.43	9.6266	0.1590
Socio Eco-Nomic Scale	Upper (I)	4	4%	1.75	4	4%	0.75	10.5263	0.1544
	Upper middle (II)	10	10%	2.73	13	13%	0.74	37.2101	0.1722
	Lower middle (III)	14	14%	2.38	17	17%	1.08	19.3547	0.1813
	Upper lower (IV)	14	14%	2.04	8	8%	0.80	13.6847	0.1736
	Lower (V)	8	8%	3.13	8	8%	0.95	22.1593	0.1577

Table-3
Grand chart showing the changes in blood parameters in the case group

SL NO.	Name	Age (yrs)	Before study report	After study report	Indv. Change	Mean increase
1.	F-1	7	28.9	31.6	2.7	
2.	F-2	10	27.3	30.4	3.1	
3.	F-3	10	26.4	30.1	3.7	
4.	F-4	29	28.6	30.9	2.3	
5.	F-5	35	29.1	30.2	1.1	
6.	F-6	36	28.1	30.1	2	
7.	F-7	38	26.4	28.4	2	
8.	F-8	39	28.9	30	1.1	
9.	F-9	41	29.2	30.2	1	
10.	F-10	43	28.4	30.2	1.8	
11.	F-11	44	27.8	30.1	2.3	
12.	F-12	45	27.9	30	2.1	
13.	F-13	47	28.6	30.1	1.5	**1.88**
14.	F-14	49	28.8	30	1.2	
15.	F-15	55	29.9	31.2	1.3	
16.	F-16	56	28.9	30.9	2	
17.	F-17	58	29.1	31.2	2.1	
18.	F-18	60	28.3	30.3	2	
19.	F-19	60	28.4	30.1	1.7	
20.	F-20	63	29.3	31.2	1.9	
21.	F-21	65	28.4	30.1	1.7	
22.	F-22	72	28.9	29.8	0.9	
23.	F-23	78	29.2	30.3	1.1	
24.	F-24	39	28.6	31.1	2.5	
25.	F-25	44	29.9	31.9	2	
26.	M-1	10	29.2	32.6	3.4	
27.	M-2	11	28.3	31.4	3.1	
28.	M-3	11	28.4	33.1	4.7	
29.	M-4	13	27.6	31.9	4.3	
30.	M-5	13	28.1	33.2	5.1	
31.	M-6	14	29.3	32.3	3	
32.	M-7	15	28.4	32.4	4	
33.	M-8	33	28.9	32.1	3.2	
34.	M-9	35	29.2	30.9	1.7	
35.	M-10	35	28.4	32.2	3.8	
36.	M-11	35	27.8	30.1	2.3	
37.	M-12	38	26.9	30.3	3.4	
38.	M-13	43	27.8	30.3	2.5	**2.96**
39.	M-14	45	28.4	31.3	2.9	
40.	M-15	49	29.1	31.2	2.1	
41.	M-16	55	26.3	29.7	3.4	
42.	M-17	58	28.4	31.1	2.7	
43.	M-18	60	28.3	30.2	1.9	
44.	M-19	60	29.2	32.6	3.4	
45.	M--20	63	29.3	31.4	2.1	
46.	M-21	65	28.9	30.9	2	
47.	M-22	72	29.2	31.2	2	
48.	M-23	75	27.3	30.1	2.8	
49.	M-24	78	26.4	28.6	2.2	
50	M-25	81	29.2	31.2	2	

Table-4
Grand chart showing the changes in blood parameters in the control group

SL NO.	Name	Age (yrs)	Before study report	After study report	Indv. Change	Mean increase
1.	F-1	10	25.9	26.9	1	
2.	F-2	10	27.3	28.3	1	
3.	F-3	11	26.4	27.5	1.1	
4.	F-4	13	26.6	27.9	1.3	
5.	F-5	14	27.1	28.2	1.1	
6.	F-6	29	25.1	26	0.9	
7.	F-7	36	26.4	27.4	1	
8.	F-8	37	24.9	25.9	1	
9.	F-9	41	29.2	30.1	0.9	
10.	F-10	41	26.4	26.4	0	
11.	F-11	45	27.8	28	0.2	
12.	F-12	46	27.9	28.1	0.2	
13.	F-13	47	28.6	30.1	1.5	**0.73**
14.	F-14	48	28.8	29.1	0.3	
15.	F-15	50	27.1	29.2	2.1	
16.	F-16	50	27.9	28	0.1	
17.	F-17	55	28.1	28.3	0.2	
18.	F-18	60	27.5	28.3	0.8	
19.	F-19	62	26.4	27.2	0.8	
20.	F-20	64	29.3	29.4	0.1	
21.	F-21	65	29.6	30.6	1	
22.	F-22	65	28.2	28.9	0.7	
23.	F-23	66	26.3	26.7	0.4	
24.	F-24	73	28.2	28.7	0.5	
25.	F-25	83	28.2	28.2	0	
26.	M-1	7	28.6	29.9	1.3	
27.	M-2	8	28.8	29.9	1.1	
28.	M-3	10	29.9	31.1	1.2	
29.	M-4	11	28.9	30.1	1.2	
30.	M-5	14	28.1	29.2	1.1	
31.	M-6	30	28.3	29	0.7	
32.	M-7	31	28.4	29.4	1	
33.	M-8	34	25.3	25.3	0	
34.	M-9	35	28.2	29.1	0.9	
35.	M-10	37	28.1	29.1	1	
36.	M-11	38	29.8	30.1	0.3	
37.	M-12	39	27.9	28	0.1	
38.	M-13	43	26.6	30.1	3.5	**1.04**
39.	M-14	45	27.8	29	1.2	
40.	M-15	48	28.9	30	1.1	
41.	M-16	55	28.2	28.3	0.1	
42.	M-17	45	26.1	28.1	2	
43.	M-18	45	27.3	28.9	1.6	
44.	M-19	65	26.4	27.1	0.7	
45.	M--20	45	27.3	29.3	2	
46.	M-21	68	28.5	29.3	0.8	
47.	M-22	68	27.9	28.5	0.6	
48.	M-23	79	28.1	29	0.9	
49.	M-24	82	27.3	27.9	0.6	
50	M-25	83	28.5	29.4	0.9	

Results and Discussion

In this study, as shown in table-1, out of 100 subjects interviewed 50% among the whole population were treated as case group, whereas rest of the 50% were treated as Control group. As shown in Figure-1, the mean increase in Vitamin-D level after study in the case group is 2.42 whereas the same for that of the control group is 0.82 (p value <0.05).

Now, as shown in table-2, 10% of the whole population were aged between 5-15 years in both of the case and control group. Whereas 18%, 8% and 14% were respectively aged between 16-45 years,46-59 years and 60 years and above in both of the case and control group. Amongst these four categories, the case group shows much increase in mean Vitamin –D level after study than that of the control group. But as shown in figure-2, percentage wise, in both case and control group, subjects having 60 years and above age group shows comparatively less increase in their Vitamin-D level after study. On the other hand, as shown in table-2, 25% of the population were of female as well as of male category respectively in both of the case and control group.

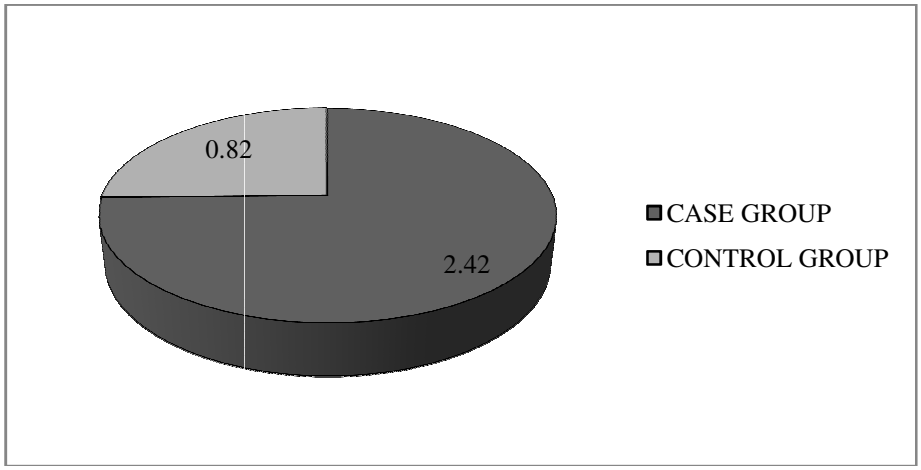


Figure-1
Mean increase in vitamin D level after study Case group vs. control group

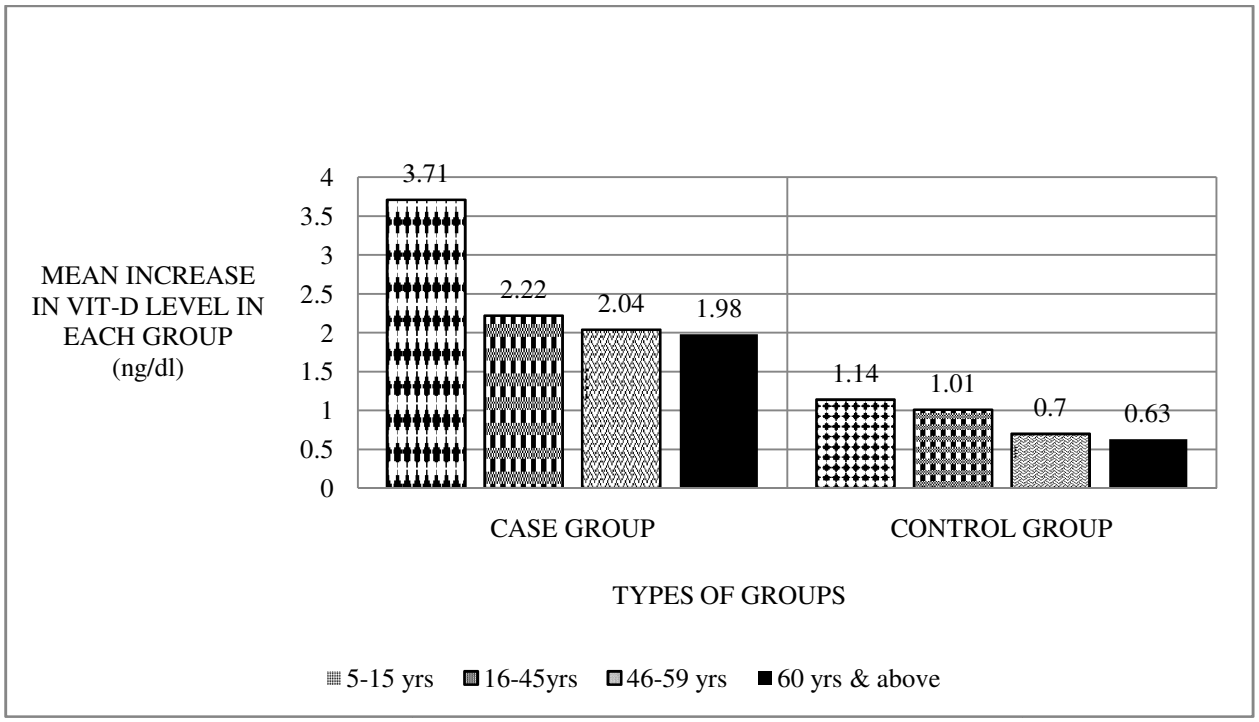


Figure-2
The mean increase in vitamin D level after study (age group wise)

In this study, as shown in figure-3, Female case group as well as control group both after study shows comparatively less increase in their mean increase in Vitamin-D level after study than that of the Male group.

Now, as shown in table-2, among the Hindu female community 22 % of the population were respectively from case group and control group. Whereas, among the Muslim female community 3% of the total population were respectively from case and control group.

Now, as shown in figure- 4, the Muslim female both in case as well as in control group shows comparatively less increase in Vitamin-D level after study than that of the Hindu female.

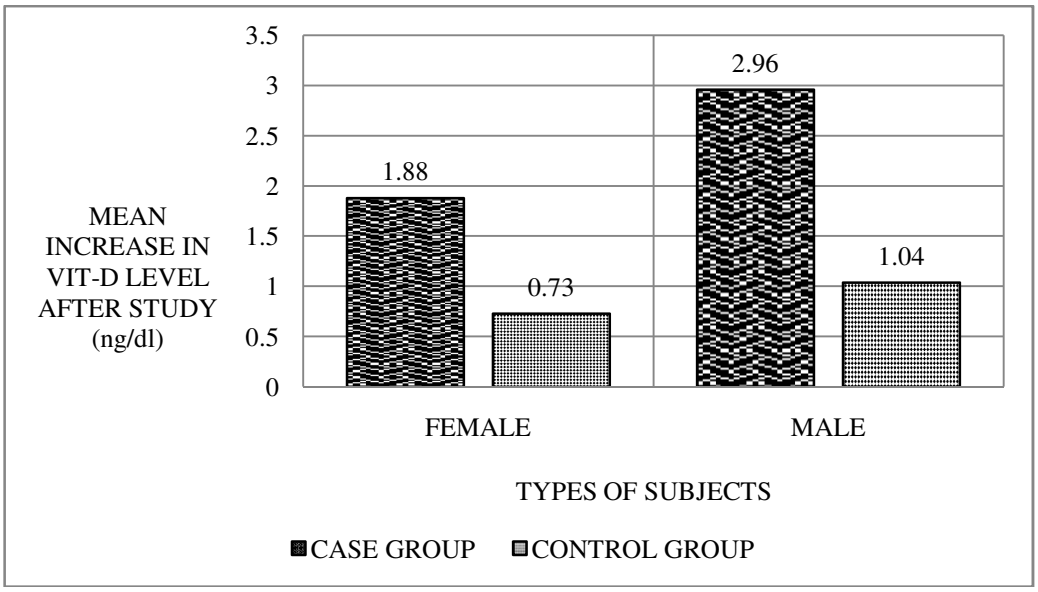
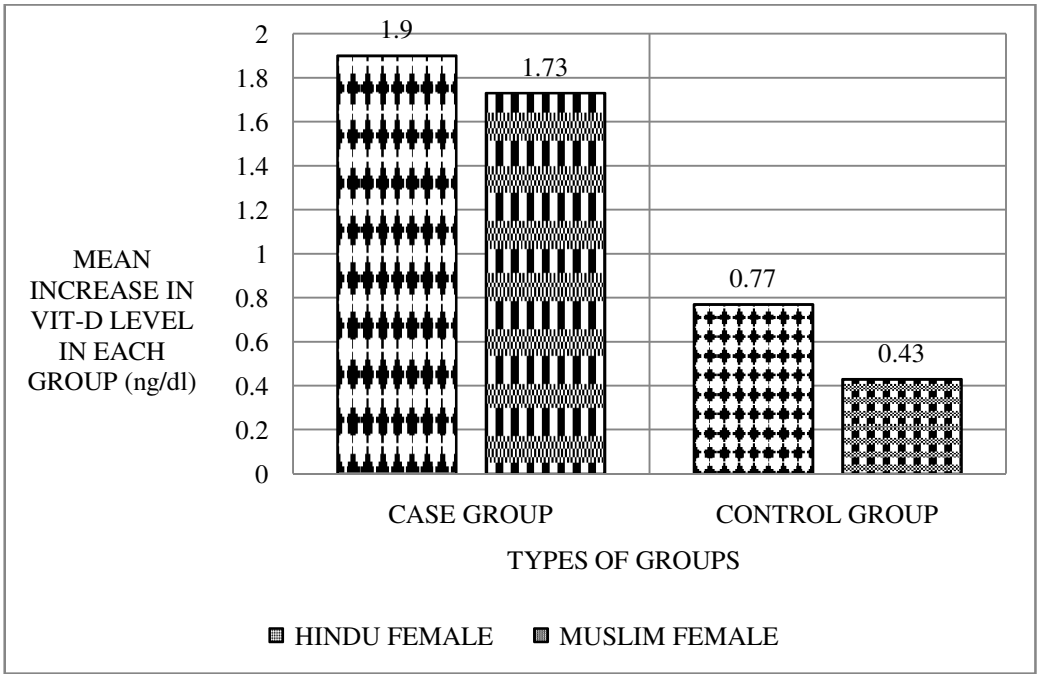


Figure-3
The mean increase in vitamin D level after study female group vs. male group



Figure–4
The mean increase in vitamin D level after study Hindu female vs. muslim female

Regarding the Socio Economic Scale as per the modified Kuppuswamy Socio Economic Scale [13] , as shown in table-2, among the case group 4%,10%,14%,14% and 8% were respectively belongs to Upper-I, Upper Middle –II, Lower Middle-III, Upper Lower-IV and Lower-V category. Similarly. among the control group-4%,13%,17%,8% and 8% were respectively belongs to Upper-I, Upper Middle –II, Lower Middle-III, Upper Lower-IV and Lower-V category.

Discussion: In this study, the case group of all age groups shows comparatively greater increase in Vitamin-D level after the study than the different age groups of that of the control group. But may be due to the physiological status as well as less exposure to sunlight the age group of 60 and above shows comparatively less increase in Vitamin-D level after the study. Similar result also seen in Holick study[14,15] which shows that 84% of African American men and women >65 years of age were vitamin D deficient at the end of the summer. The reasons for this are that African Americans often have a lactase deficiency and do not drink milk, they have markedly decreased efficiency in making vitamin D_3 in their skin, and they avoid the sun because they do not want to increase their skin pigmentation. On the other hand, the female case group shows comparatively less increase in Vitamin-D level after the study than the male case group. It may be due to the improper maintaining of food habits which are rich in Vitamin-D as well as due to less exposure to sunlight than that of the male group. In this study, both of the case and control group of the Hindu female group shows comparatively better increase in the increase in Vitamin-D level after study than that of the Muslim females. It may be caused due to the religious belief of the Muslim women like wearing of "Barque" which may cause less exposure to sunlight. In our study, the Muslim female shows comparatively less elevation in their Vitamin-D level after study both in case and control group. Similar result were seen in Nesby-O'Dell et al study[14,15], which shows that women in Saudi Arabia have high prevalence of Vitamin-D deficiency because of their practice of wearing clothing over the whole body and avoiding direct sunlight.

Conclusion

From the present study, we conclude that the Diet therapy and sunlight exposure has a marked effectiveness in elevation of Vitamin-D level. The change in Vitamin-D level also depends upon the demographic factors like age, sex, caste and socio-economic status.

Recommendations: To prevent Osteomalacia, Ricket, Osteoarthitis from the very beginning it is essential to consume Vitamin .D rich foods along with enough sunlight exposure. Simultaneously after the age of 45 years at least checking of 1, 25 dihydroxycolecalciferol is also required as a previous protection.

Limitations: Our study population was mainly from Hindu community. A very minimal percentage belongs to other community; this limits us from making our findings more specific.

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