International Journal of Medical Ophthalmology

**E-ISSN:** 2663-8274
**P-ISSN:** 2663-8266
www.ophthalmoljournal.com
IJMO 2021; 3(1): 110-112
Received: 21-03-2021
Accepted: 04-04-2021

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# A case control study of estimation of vitamin D3 levels in patients with lenticular opacity aged between 18-50 years in a tertiary institute in India

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**DOI:** https://doi.org/10.33545/26638266.2021.v3.i1b.74

**Abstract**
**Background & Objectives:** Ocular diseases like cataract, diabetic retinopathy, glaucoma and ARMD are some of the ocular associations observed in patients with deficient Vitamin D levels. Although earlier studies have addressed the issue of metabolic factors leading to cataract in infants, studies on adults is lacking. In our current study we intend to assess and analyse the serum vitamin D3 levels in patients with early cataractous changes aged <50 years, attending our out-patient department versus normal patients.
**Methods:** The current study was a prospective case control study conducted on 54 subjects, aged 18-50years, divided into two equal groups (Group 1 – cataract patients, Group 2- Non cataractous) from May 2020 to May 2021. Grading and classification of cataracts was done by LOCS –Lens opacity classification system using a Slit-lamp. Blood sample of 5ml was taken from each patient and assayed for levels of vitamin D3. P<0.05 was taken as the level of significance of the study.
**Results:** Patients in both groups were matched for age and gender, showed no statistical difference. In the cataract group the most common morphogical type of cataract was cortical cataract (34.3%) followed by the posterior subcapsular cataract 38.3% and 27.4% of patients accounted for nuclear cataract. Mean Vitamin D3 level observed in the cataract group was 13.9±5.32 , while mean 25-OH D level in the control group was 21.63 ± 10.6 ng/mL, which was statistically significant at P value < 0.05, although cataract group were categorised to have frank vitamin D3 deficiency, control group was categorised as vitamin D3 insufficiency as per recommended national Vitamin D3 levels. We did not find any correlation with the type of cataract and vitamin D3 levels in our patients.
**Conclusion:** Although a direct link to decreased serum Vitamin D3 and cataract can be established, the type of cataract developing due to vitamin D deficiency is debatable and more studies are needed. Perhaps those studies which estimates and correlates ocular vitamin D3 levels with systemic or serum Vitamin D3 levels would provide a much better analysis of the above research question.

**Keywords:** vitamin D3, cataract, cortical, posterior subcapsular, nuclear

## Introduction

Early cataract in patients <50 years is usually due to systemic anomalies like metabolic disorders, life style changes, chronic malnutrition, diabetes, long term steroid use, genetic or hereditary disorders like myotonic dystrophy, hypoparathyroidism, neurofibromatosis, down's syndrome etc [1, 2, 3]. Ocular conditions leading to early cataractous changes include retinitis pigmentosa, trauma, high myopes and intra ocular inflammatory processes like uveitis causing complicated cataract [4, 5].

The major pathogenesis of most of the metabolic cataracts and inflammatory cataracts is oxidative stress induced by free radicals generated systemically and locally [6, 7]. Usually the body defences are adequate to fight off these oxidative stresses in normal healthy individuals, but in individuals with imbalance or deficiency of free radical scavenging entities like vitamin C, glutathione, vitamin A, vitamin E, peroxide system, catalase systems can lead to development of early cataracts [8, 9]. Recently the role of Vitamin D in dealing with oxidative stress is called into question. A few research studies have elucidated a direct relation to a decreased vitamin D3 (active form of vitamin D) and cataract, although large scale studies to assess direct temporal relationship is lacking [9, 10, 11].

Proven studies have elucidated Vitamin D3 to have anti–inflammatory properties by antagonizing the excessive activation of cytotoxic T cells, leading to decreased release of pro-inflammatory chemical mediators, and cytokines [12]. Even though Vitamin D is easily accessible by sunlight, there are a substantial number of patients presenting with characteristics of deficiency [13]. ≥30 ng/mL of 25-hydroxy vitamin D level in the serum is considered to be normal, values ranging from 21–29 ng/mL is vitamin D insufficiency and

values under 20 ng/mL termed as vitamin D deficient patients [12, 13]. Ocular diseases like cataract, diabetic retinopathy, glaucoma and ARMD are some of the ocular associations observed in patients with deficient Vitamin D levels [14, 15]. Although earlier studies have addressed the issue of metabolic factors leading to cataract in infants, studies on adults is lacking [16]. Hence estimation of Vitamin D3 status in patients with cataract can be used to accord Vitamin D3 as a modifiable risk factor in prevention and early management of the above mentioned ocular conditions. In a developing country like ours with limited resources, identifying a modifiable risk factor would help to increase the cost-effectiveness, prevent and delay cataractogenesis. In our current study we intend to assess and analyse the serum vitamin D3 levels in patients with early cataractous changes aged <50 years, attending our out-patient department versus normal non cataractous patients, who form the control group.

## Methods

The current study was a prospective case control study conducted on 54 subjects, conducted in the Ophthalmology Department of a tertiary institute in India from May 2020 to May 2021 after due clearance from the Institutional ethics committee. A patient information sheet was provided to all patients and informed consent was obtained from all those who willingly participated in the study. Inclusion criteria are as follows: patients with age of 18-50 years, with clinically significant unilateral or bilateral cataract. Exclusion Cataract secondary to systemic or ocular cause/complicated cataract, long term ocular medications like steroids, any intra ocular surgery, blunt trauma, diabetes mellitus, chemotherapy, long term drugs for any disease/disorder, hypertension, chelating agents, CVS disorders. A control group of 27 patients without cataract and fitting the inclusion and exclusion criterion were included as a comparator group.

Grading and classification of cataracts was done by LOCS - Lens opacity classification system using a Slit-lamp [17, 18]. Blood sample of 5ml was taken from each patient and assayed for levels of vitamin D3. In case of haemolysed blood sample, that patients sample was excluded from the study. All samples were sent to the biochemistry lab of our institute and values obtained were noted. ≥30 ng/mL of 25-hydroxy vitamin D level in the serum is considered to be normal, values ranging from 21–29 ng/mL is vitamin D insufficiency and values under 20 ng/mL termed as vitamin D deficient patients [19, 20]. 25-OH D estimation was done by Biomerieux Mini VIDAS system available at our institute.

Statistical Analysis: All data was analysed using Statistical package for social studies SPSS ver 21.0. mean ± standard deviation, median, and range were used for quantitative data. $P<0.05$ was taken as the level of significance of the study.

## Results

Out of the 54 subjects enrolled, the mean age of the study population in the cataract group was 38.38±4.52 years and in the control group it was 36.11±3.88 years. The cataract group consisted of 18 males and 9 females whereas in the control group it was 15 males and 12 females. Patients in both groups were matched for age and gender, showed no statistical difference. In the cataract group, unilateral cataract was noticed in 21 patients whereas bilateral cataracts were observed in 6 patients. In the cataract group the most common morphogical type of cataract is cortical cataract (34.3%) followed by the posterior subcapsular cataract 38.3% and 27.4% patients accounted for nuclear cataract. Mean Vitamin D level observed in the cataract group was (13.9±5.32 [11.11–16.32] ng/ml), median was 9.84 ng/mL (2.6–31.9) compared to age/sex-matched national standards for vitamin D3 levels which is categorized as severe deficiency. While mean 25-OH D level in the control group was 21.63 ± 10.6 ng/mL, also categorized as vitamin D3 insufficiency, which was statistically significant at P value < 0.05. We did not find any correlation with the type of cataract and vitamin D3 levels in our patients.

**Table 1:** Demographic data $P>0.05$(no statistical significance)

| Gender | Male | Female | Total |
|---|---|---|---|
| Cataract Group | 18 | 9 | 27 |
| Control Group | 15 | 12 | 27 |
| | 33 | 21 | 54 |

**Table 2:** Mean Vitamin D3 estimation in age matched controls among Cataract group and non-cataract group. $p<0.05$

| Age in years | Mean Vitamin D3 Cataract Group | Mean Vitamin D3 Control Group |
|---|---|---|
| 18-30 | 5(14.63±5.66) | 7(23.75±4.89)* |
| 31-40 | 9(15.39±7.43) | 10(19.3±6.33)* |
| 41-50 | 13(11.57±5.21) | 10(21.83±4.94)* |
| Total | 27(13.9±5.32) | 27(21.63±10.6)* |

**Table 3:** Mean Vitamin D3 levels in different morphological types of cataract ($p>0.05$)

| Type of Cataract | Frequency n= | Mean Vitamin D3 in Cataract group |
|---|---|---|
| Cortical cataract | 9 | 14.42±6.42 |
| Posterior Sub-capsular Cataract | 11 | 12.81±7.73 |
| Nuclear Cataract | 7 | 14.51±6.94 |
| | 27 | 13.91±5.32 |

## Discussion

Vitamin D3 deficiency as a modifiable risk factor in patients with ocular diseases like diabetic retinopathy, glaucoma and cataract has not been studied as frequently and as in depth as of the other micronutrient associations in ophthalmology [14, 15]. Although direct comparative studies similar to our studies are lacking, the mean vitamin D3 levels estimated in our study was 13.9±9.3 and 21.63 ± 10.6 ng/mL in the cataract group and the control group respectively. Clinically these values sided towards a frank deficiency of vitamin D3 levels in the cataract group, while non-cataract group were categorised as Vitamin D3 insufficiency. On statistical analysis there was a significant difference between the two groups at $p<0.05$. Similar findings were echoed by another study conducted by Abdellah *et al*, [15] wherein Vitamin D3 levels among 1222 cataract patients was sub-normal in both the study and control group, although there was greater reduction observed in cataract patients than non-cataract patients. Similar Vitamin D3 deficient states in cataract patient were observed in studies conducted by Jee D *et al*, [10] and Millen AE *et al*. [13].

There was a significant statistical and clinical difference in the vitamin D3 levels in cataract patients which showed a greater reduction in Vitamin D3 levels than in non-cataract patients. The difference observed showed a generalised

reduction in vitamin D3 levels in both groups, although more so in the cataract group can also be attributed to ethnic background, geo location, dietary habits and lifestyle [21]. Similar thoughts and observations were seconded by a Korean study conducted by Jee D *et al*. [10].

Vitamin D3 levels and its correlation with the morphological type and grade of cataract, in our study did not show any statistical significance, although studies conducted by Park S *et al*. [22] and Rao P *et al*. [23] showed a greater reduction in vitamin D3 levels in nuclear cataract than those of other types of cataract. However, a few studies have demonstrated a greater reduction of Vitamin D3 levels in posterior subcapsular cataract than that of other variants [24].

## Conclusion

Vitamin D deficiency is a modifiable risk factor in patients developing early cataract and it is evident from a greater reduction in Vitamin D3 levels in the cataract group, although a larger sample size, with age matched controls, taking into consideration geo location, dietary habits and life style should also be considered when conducting the study. Although a direct link to decreased serum Vitamin D3 and cataract can be established, the type of cataract developing due to vitamin D deficiency is debatable and more studies are needed, perhaps which also considers and estimates and correlate ocular vitamin D3 levels with systemic or serum Vitamin D3 levels.

**Lacunae of the study:** Small sample size, confounding bias due to ethnicity, life style and dietary habits.

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