

# The Prevalence of Vitamin D Deficiency in Migraine Headache Patients & its Response to Vitamin D Replacement in Deficient Patients

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## Abstract

Migraine is a common neurovascular disorder that causes significant morbidity, in terms of quality of life. The migraine syndrome consists of a moderate to severe recurrent, unilateral, throbbing headache lasting hours to days, which is generally accompanied by nausea, photophobia, phonophobia, and is worsened by routine physical exertion. A few studies have shown a positive relationship between vitamin D and migraine headaches. And, it is common to encounter migraine headache and low levels of vitamin D in Indian population suggesting a common link between them. This article is a study of prevalence of vitamin D deficiency in migraine headache patients amongst the north Indian population, to assess & correlate vitamin D levels with the severity of migraine headache, to study the effect of supplementation of vitamin D in patients of migraine with vitamin D deficiency.

**Keywords:** Headache; Migraine; Vitamin D Deficiency

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## Introduction

Derived from the Greek word “ημικρανία” (hemikrania), Migraine means ‘pain on one side of the head’. Migraine is a common neurovascular disorder with instability in the way the brain is dealing with the sensory information that is incoming. The Migraine syndrome consists of a moderate to severe recurrent, unilateral, throbbing headache lasting hours to days, which is generally accompanied by nausea, photophobia, phonophobia and is worsened by routine physical exertion [1]. This sensory sensitivity is said to be due to dysfunction of monoaminergic sensory control systems, particularly CGRP, 5-Hydroxytryptamine and Dopamine. In recent years, many studies have highlighted the role of vitamin D levels in development of various diseases. Vitamin D is a steroid which not just has its role in calcium homeostasis and bone health but possesses apoptotic, anti-inflammatory and immunomodulatory properties [2]. Vitamin D is also needed in serotonin synthesis. As increase in serotonin decreases CGRP levels, it is common to encounter migraine headache and low levels of vitamin D in Indian population suggesting that there may be a common link between the two diseases [3]. A study was conducted by our department in Chhatrapati Shivaji Subharti Hospital, Meerut to assess the correlation of serum vitamin D level with the clinical severity & duration for each patient.

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## Methodology

50 patients diagnosed to be suffering from migraine as per IHS (International Headache Society) guidelines were selected for inclusion in the study. Thus, study population consisted of 100 patients, 50 age and sex matched healthy individuals with similar socio-economic status were taken as controls [4]. Detailed history and examination was carried out in all the patients. Serum vitamin D levels were done in all the cases and controls.

## Statistical methods used

Quantitative data was presented as mean  $\pm$  SD or median and inter-quartile range, as appropriate. Normality of quantitative data was checked by measures of Kolmogorov Smirnov tests of normality. For categorical variables number & percentages were calculated. Frequency of migraine headache was presented as median and interquartile range. For two groups cases & control continuous variables were compared using Mann Whitney U test. Comparisons of continuous variables between three groups

of Vitamin D were done by One-Way ANOVA followed by Post-Hoc Multiple comparisons or Kruskal Wallis test. For all patients vitamin D levels were done & prevalence of deficient patients was calculated. Chi-square test or Fisher's exact test was applied for categorical data. Multinomial regression was carried out to find the independent predictors of headache days (divided into categories). All calculations were two side & performed using SPSS version 17 (Statistical Packages for Social Sciences, Chicago). A *P* value of <0.05 was considered to indicate statistical significance.

## Observation

The mean ( $\pm$  SD) age of study group was  $27.7 \pm 1.00$  years, while in the control group it was  $32.52 \pm 1.52$  years. In the study group, 13 (26%) patients were men and 37 (74%) patients were women, 30 (60%) patients were <30 years of age and 20 (40%) patients were >30 years of age. The control group included 29 women (58%) and 21 men (42%). 20 (40%) controls were <30 years of age and 60 (65.5%) were >30 years of age. The mean duration of headache in our study population was  $73.96 \pm 1.30$  months. For purpose of analysis, study group was further subdivided as per duration of headache into 3 groups. 28 (56%) patients were symptomatic for < 60 months. 16 (32%) were symptomatic for 60-120 months whereas 6 (12%) were symptomatic for > 120 months. Severity of pain was assessed in entire study group as per 0 to 10 numeric pain rating scale. 16 (32%) patients had pain severity score < 5 while 34 (68%) patients had pain severity score > 5 (**Table 1**).

The degree of disability was assessed in study population according to MIDAS questionnaire based on this score into subgroups: Little or no disability, mild, moderate and severe disability. 1 (2%) of patients had little or no disability, 14 (28%) had mild, 20 (40%) had moderate and 15 (30%) patients had

severe disability. We carried out vitamin D levels in all the cases and controls. Mean  $\pm$  SD levels of vitamin D was  $16.97 \pm 1.03$  ng/ml in study group, while in control group levels were  $21.26 \pm 1.9$  ng/ml. The subjects with vitamin D levels  $\leq 20$  ng/ml and were classified as 'deficient', subjects with vitamin D levels between 20-29 ng/ml were classified as 'insufficient' and subjects with vitamin D levels more than 30 ng/ml were named as 'sufficient'. In the study group, 38 (76%) patients were found to be deficient in vitamin D, 08 (16%) were insufficient and 04 (08%) were found to have sufficient levels of vitamin D. In control group 18 (36%) patients were found to be deficient in vitamin D, 20 (40%) were insufficient and 12 (24%) were found to have sufficient levels of vitamin D.

Among the migraine headache patients, 26 (52%) had headache duration of <60 months, out of which 15 (57.6%) had deficient, 08 (30.8%) had insufficient and 3 (11.6%) had sufficient levels of vitamin D. In group with 60-120 months duration [n=17 (34%)], we had 10 (58.8%) patients with deficient, 05 (29.4%) with insufficient and 02 (11.8%) with sufficient levels of vitamin D. Among the headache patients with duration > 120 months [n= 07 (14%)], 4 (57.1%) had deficient levels, 02 (28.6%) had insufficient levels, and 01 (14.3%) had sufficient levels of vitamin D. Among the patients with migraine attack of <4 hours duration (n=21), 10 (47.6%), 07 (33.3%) and 04 (19.1%) had deficient, insufficient and sufficient vitamin D levels respectively. Among the patients with duration of attack ranging from 4-72 hours (n=28), 16 (57.1%), 8 (28.6%) and 04 (14.3%) had deficient, insufficient and sufficient vitamin D levels, respectively. The only patient with duration of attack >72 hours group had deficient vitamin D levels respectively. Relation between levels of vitamin and associated symptom of migraine was also studied. Out of 50 patients in study group, 39 had nausea, 24 had vomiting, 36 had photophobia, 44 had phonophobia and 07 had aura (**Graphs 1 and 2**).

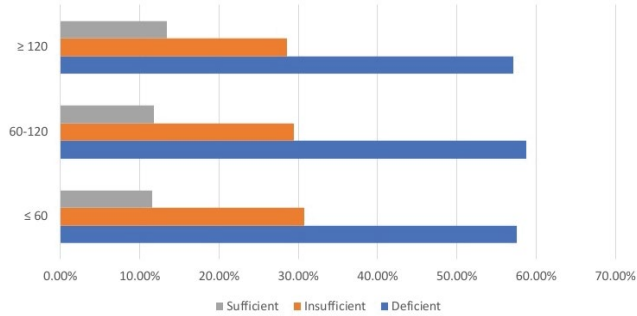
The patients, who were followed up, after Vitamin D supplementation, were included in the study, following compliance ensured verbally. Supplementation was done *via* injectable as well as oral routes, accordingly. A minimum of 4 weeks and maximum of 8 weeks of supplementation was ensured, before re-sampling of the patient (**Graphs 3 and 4**).

## Results

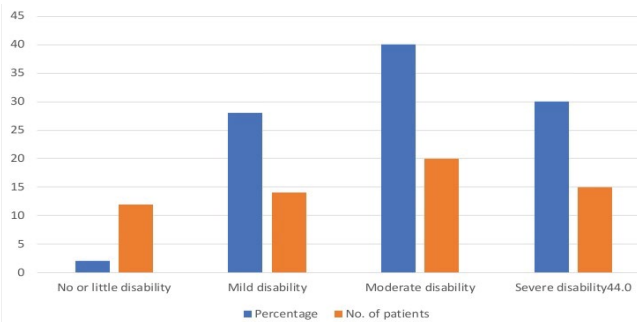
Females formed a majority in our study, and most of the patients were in the age group of less than 30 years of age. More than half the patients had migraine for less than past 60 months of duration, and very low members had the headache for more than 120 months. Majority of the patients had the pain lasting between 4-72 hours. More than half the patients complained of headache unilaterally. Almost all the patients complained of throbbing headache, with vast majority having accompanying nausea, vomiting, phonophobia followed by photophobia in more than half the patients. Very few patients complained of aura. Majority of patients having headache had <30 headache days in the past 3 months. Vast majority of patients had a pain severity score of more than 5. Majority of patients had headache leading to moderate to severe disability. Majority of patients in the study group are vitamin D deficient or insufficient, but a

**Table 1** The clinical characteristics of the study population.

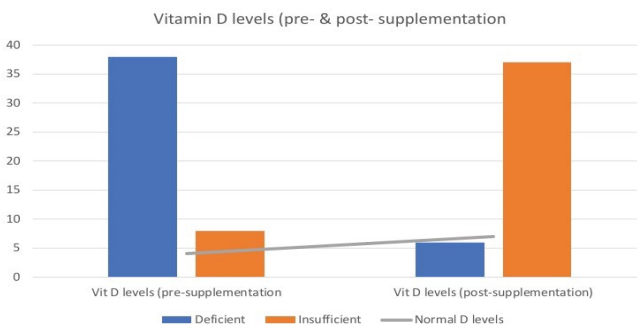
Parameters	Value
<b>Duration of Headache (mean <math>\pm</math> SD)</b>	<b>73.96 <math>\pm</math> 1.30</b>
No. of patients with duration < 60 months	28 (56%)
No. of patients with duration 60-120 months	16 (32%)
No. of patients with duration >120 months	06 (12%)
<b>Mean Duration of Headache</b>	
No. of patients with headache attack <4 hours	15 (30%)
No. of patients with headache attack 4-72 hours	34 (68%)
No. of patients with headache attack >72 hours	01 (02%)
<b>Location of Headache</b>	
Holocranial	18 (36%)
Unilateral	28 (56%)
Frontal	04 (08%)
<b>Character of Headache</b>	
Throbbing	40 (80%)
Pulsatile	10 (20%)
<b>Associated Symptoms</b>	
Nausea	39 (78%)
Vomiting	24 (48%)
Photophobia	36 (72%)
Phonophobia	44 (88%)
Aura	07 (14%)



**Graph 1** Effects of Vitamin D levels on duration of headache.



**Graph 2** Prevalence of disability in study population.

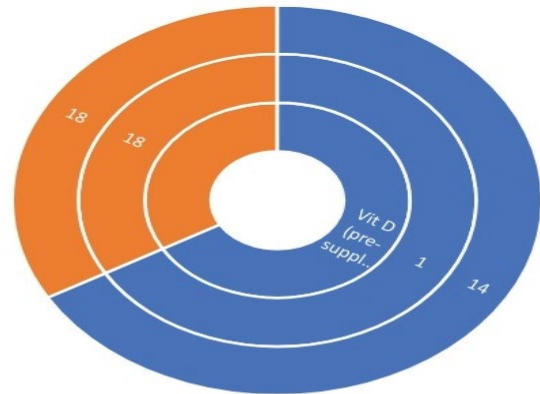


**Graph 3** Improvement of migraine with Vitamin D levels in cases pre- & post-supplementation.

lesser majority of the same in the control group. Females were found to be more deficient in Vitamin D, in both study and control groups. In patients whose history of headache were less than 60 months or between 60 to 120 months or more than 120 months – in all the cases, majority of patients were found to be vitamin D deficient. In patients studied having duration of headache less than 4 hours, half the patients were vitamin D deficient. In patients having headache of duration between 4-72 hours or more, majority had vitamin D deficiency and insufficiency.

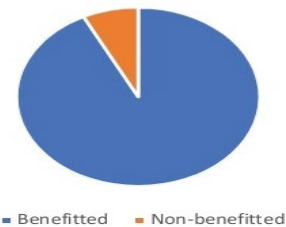
Most of the patients who were followed up, had improved Vitamin

Correlation of symptom improvement with Vitamin D levels



**Graph 4** Correlation of symptom improvement in the cases with Vitamin D supplementation.

Vit. D supplemented Migraine patients



D levels. Follow up of Vitamin D deficient migraine patients was done minimum after 4 weeks of supplementation. More than three-quarters of the patients with improved Vitamin D levels, had significant improvement in migraine symptoms, as qualified by MIDAS questionnaire, following supplementation. Hence, in our study, the correlation of deficient serum vitamin D level was positively significant with the prevalence & severity of migraine.

## Conclusion

In our study, the correlation of serum vitamin D level was significant with prevalence of migraine. We found that there is a positive correlation between lower serum vitamin D levels and severity & duration of migraine. Lower vitamin D levels were found in more severe migraine. Vitamin D deficient and insufficient patients, were more prone to develop migraine.

So, serum vitamin D levels can be used to assess the proneness, severity and duration of migraine & can also be an important predictor of clinical outcome in migraine. Patients with improved Vitamin D levels, had significant improvement in migraine symptoms, as qualified by MIDAS questionnaire, following supplementation. Hence, the vitamin D levels correlated well with the incidence of migraine during the hospital visit, suggesting that the serum vitamin D levels was an indicator of the clinical outcome of the patients during their hospital visit.

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