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ASSOCIATION OF SERUM VITAMIN D LEVEL WITH MYOPIA IN CHILDREN AND YOUNG ADULTS IN THE AGE GROUP 10 – 25 YEARS

Biochemistry

Dr. Keshab Bora* Associate Professor of Biochemistry, Fakhruddin Ali Ahmed Medical College, Barpeta, Assam. *Corresponding Author

Dr. Barnali Bhattacharyya Thakur Professor & Head of Biochemistry, Nagaon Medical College, Nagaon, Assam.

Dr. Mridusmita Das Assistant Professor of Biochemistry, Gauhati Medical College, Guwahati.

ABSTRACT

INTRODUCTION: The incidence of hypovitaminosis D has been increasing now a days in children due to decreased outdoor activity. Myopia is an important cause of ocular morbidity especially in younger generations like school-going children and young adults. Therefore, it is important to investigate whether there is any association between them. **OBJECTIVE:** To find association between Vitamin D level and myopia in the age group of 10 – 25 years. **MATERIALS AND METHODS:** This study was a hospital-based case control study. A total number of 32 patients with myopia and 32 healthy individuals without any ocular disease were taken as cases and control respectively. In this particular study we have taken the cases of myopia whose refractive error of an eye is ≥--1 D during relaxed ocular accommodation. Serum Vitamin D was estimated in Vitros 5600 autoanalyzer by immunoassay method. Statistical analysis was carried out by using IBM SPSS version 23. **RESULTS AND OBSERVATION:** 3.1% and 6.3% of the control population has deficient and insufficient serum Vitamin D concentration respectively whereas 15.6% and 28.1% of the myopia cases have deficient and insufficient serum Vitamin D concentration respectively ($p<0.05$). In the unadjusted logistic regression model, it was seen that the odds of having myopia decreased with increasing value of serum vitamin D concentration, and increased across categories of decreasing vitamin D status. In the adjusted model, the odds of having myopia decreased with increasing value of serum vitamin D concentration. The mean (±SD) serum vitamin D levels in myopia and non-myopia are 31.2 (±9.8) ng/ml and 43.9 (±15.6) ng/ml respectively($p<0.0001$). **CONCLUSION:** From the findings of the study, it can be concluded that young patients with myopia have lower serum Vitamin D level than normal healthy individuals and there is an association between hypovitaminosis D and myopia.

KEYWORDS

Vitamin D, Myopia, Children, Young adults

INTRODUCTION

Myopia is defined as a refractive condition of the eye in which parallel rays of light entering the eye are brought to a focus in front of the retina when the ocular accommodation is relaxed [1]. It is also known as nearsightedness and is a common refractive error leading to visual impairment. It is an important cause of ocular morbidity especially in younger generations like school-going children and young adults [2]. It has become a major public health problem globally, with a prediction of up to 50% of the world population will be myopic by 2050 [3]. Uncorrected myopia can have huge social, psychological, economic, and developmental implications [2]. In addition, due to the degenerative changes in the retina and the optic disc, the irreversible vision-threatening sequel seems inevitable [4].

India has overthrown China as the most populated country in the world in 2023, with around 41% of its population being less than 18- years of age [5]. This young population is an important asset for the nation's development, and their challenges need to be addressed on time. While rising myopia is a cause of concern, it is not being given due importance in India due to a paucity of scientific literature in Indian set ups [6,7]. The prevalence of myopia has been estimated to be 5.3% in Indian children and 35.6% in adults [8,9]. The hospital-based epidemiological studies of pediatric eye disease in Assam, India is even more confined. A previous study by Sarma KD et al conducted at schools of Guwahati, Assam, showed a prevalence of myopia in about 81.92% out of the study population of 400 (school going children from 6 to 16 years) [10]. Along with genetic susceptibility, numerous environmental factors like near work, increased screen use, and time spent outdoors are also recognized as conducive factors for the development and progression of myopia [11-13]. A novel factor that has been under a lot of scrutiny by researchers for its association with myopia is the serum vitamin D3 (vit D3) level [14]. Kwon JW et al and Tang SM et al found the serum vit D3 level as a substitute or a marker of time spent outdoors, whereas few suggest it as an independent factor associated with myopia [15,16].

Vit D3 (cholecalciferol) is a fat-soluble vitamin that regulates calcium and phosphorus metabolism with $1,25(OH)_2D$ (calcitriol) as its active metabolite [17]. Vit D3 is majorly formed in the skin on sunlight exposure and is activated in liver and kidney. It is also obtained from dietary sources [18]. In the Indian population, children have a higher incidence of hypovitaminosis D (84.9% to 100%) as compared to adults [19]. There is also adequate evidence through animal studies, clinical trials and population studies that there is a link between myopia and insufficient time spent outdoors [20]. Two main theories have been put forward to explain the relationship. Firstly, the bright light from the sun is beneficial in releasing enhanced levels of dopamine in the retina [21,22] and secondly that its beneficial effect results from increased serum 25-hydroxyvitamin D (25(OH)D) [23].

This study has been designed to find an association between serum vitamin D level with myopia in children and adolescent in the age group 10 – 25 years.

Aims and objectives of the study are to estimate serum vitamin D levels in children and adolescents aged 10 to 25 years with myopia and to establish the association between Vitamin D deficiency and myopia.

MATERIALS AND METHODS

This study was a hospital-based case control study conducted at Gauhati Medical College and hospital from September, 2021 to May, 2022. Institutional Ethics Committee clearance was taken prior to conducting the study.

Inclusion Criteria:

- Diagnosed cases of myopia
- Age group between 10 to 25 years and both sexes were included

Exclusion Criteria:

- Patients with renal and hepatic disease or systemic disease associated with myopia such as diabetes mellitus, glaucoma, marfans syndrome, downs syndrome etc were excluded
- Patients taking vitamin D or calcium supplements
- Patients with any other ocular disease and having history of refractive surgery

Sample size was calculated with the help of OpenEpi software considering two-sided confidence level as 95% and power as 80%. A total number of 32 patients with myopia and 32 healthy individuals without any ocular disease were taken as cases and control

respectively. An informed and written consent was obtained from the study participants along with the consent of their parents/ guardians for patients aged less than 18.

All study participants were subjected to detailed history and clinical examinations and findings were documented. Systemic examination was done. The subjects underwent Best Corrected Visual Acuity (BCVA) testing using snellen's chart, slit lamp bio microscopy, fundus evaluation using +90D lens. The intraocular pressure was measured using an applanation tonometer. The diagnosis of myopia was made after post-cycloplegic auto refraction. Tropicamide 1% was instilled into both eyes for a period of 30 minutes at 10 minutes interval. Mean Spherical Equivalent (MSE) was used to define myopia. In this particular study we have taken the cases of myopia whose refractive error of an eye is >--1 D during relaxed ocular accommodation.

Serum Vitamin D was estimated in Vitros 5600 autoanalyzer by immunoassay method. The vitamin D status is categorized on the basis of serum vitamin D levels as follows:
Deficient: <20 ng/ml [24]

Insufficient: 20 – 30 ng/ml [24]

Sufficient: 30 – 100 ng/ml [24]

Statistical Analysis:
Statistical analysis was carried out by using IBM SPSS version 23. Descriptive analysis was done by calculating mean and standard deviation. The association between categorical variables were tested by Pearson's Chi square/Fishers exact test. The continuous variable was tested by students t test. Univariate and multivariate logistic regression were carried out to see the effect of covariates on dependent variable. P value less than 0.05 was considered statistically significant.

RESULTS AND OBSERVATION

Age and sex distribution of subjects: In the control group, the age of the subjects ranged from 10 to 25 years, with a mean of 18.16 years and a standard deviation of 4.31. The majority of them belonged to the age group of 16 to 20 years constituting 40.6% of the total. Out of a total of 32 controls 15 were male (46.9%) and 17 were female (53.1%). The age of the patients ranged from 10 years to 25 years, with a mean of 19.44 years and a standard deviation of 4.17. The pick incidence of the disease was observed in the age group of 16 to 25 years (81%). Out of a total of 32 cases 18 were male (56.3%) and 14 were female (43.7%).

Table 1: Demographic Characteristics Of The Study Participants

Characteristics		Myopias (n=32)		Control (n=32)		Total (n=64)		p value
		No.	%	No.	%	No.	%	
Sex	Male	18	56.3	15	46.9	33	51.6	0.453
	Female	14	43.7	17	53.1	31	48.4	
Age (years)	10-15	6	18.8	9	28.1	15	23.4	0.609
	16-20	13	40.6	13	40.6	26	40.6	
	21-25	13	40.6	10	31.3	23	35.9	

Table 2: Association Of Vitamin D3 Status With Myopia

Vitamin D status	Myopias (n=32)		Control (n=32)		Total (n=64)		p value
	No.	%	No.	%	No.	%	
Sufficient	18	56.3	29	90.6	47	73.4	0.008
Insufficient	9	28.1	2	6.3	11	17.2	
Deficient	5	15.6	1	3.1	6	9.4	

Table 2 shows that 3.1% and 6.3% of the control (Non-myopia) population has deficient and insufficient serum Vitamin D concentration respectively whereas 15.6% and 28.1% of the myopia cases have deficient and insufficient serum Vitamin D concentration respectively which is statistically significant with a p value of 0.008.

Table 3: Logistic Regression Analysis Of Associations With Myopia

Covariates		Unadjusted		Adjusted	P value
		OR (95% CI)	P value	OR (95% CI)	
Age (years)		1.076 (0.955 – 1.211)	0.228	1.114 (0.961 – 1.291)	0.151
Sex	Female	Reference			
	Male	1.457 (0.544 – 3.901)	0.454	1.884 (0.539 – 6.581)	0.321
Vitamin D level		0.904 (0.848 – 0.963)	0.002	0.908 (0.831 – 0.992)	0.033
Vitamin D status	Sufficient	Reference			
	Insufficient	8.056 (0.870 – 74.626)	0.066	1.123 (0.052 – 24.314)	0.941
	Deficient	7.250 (1.405 – 37.419)	0.018	2.808 (0.377 – 20.902)	0.313

Table 3 shows the results of the adjusted and unadjusted logistic regression models. In the unadjusted model it was seen that the odds of having myopia decreased with increasing value of serum vitamin D concentration (OR= 0.904, 95% CI 0.848 – 0.963, P=0.002), and increased across categories of decreasing vitamin D status (OR=7.250, 95% CI 1.405 – 37.419 for vitamin D deficiency versus sufficiency). In the adjusted model, the odds of having myopia decreased with increasing value of serum vitamin D concentration (OR= 0.908, 95% CI 0.831 – 0.992, P=0.033).However, there was no significant association across different categories of Vitamin D status.

Table 4: Distribution Of Mean Vitamin D Values With Myopia

Study participants	Mean ± SD	t value	P value
Myopia (n=32)	31.2±9.8	3.891	<0.0001
Non-myopia (n=32)	43.9±15.6		

*SD-Standard deviation

Table 4 shows that mean (±SD) serum vitamin D levels in myopia and non-myopia are 31.2 (±9.8) ng/ml and 43.9 (±15.6) ng/ml respectively, which was statistically significant (p<0.0001)

Table 5: Distribution Of Mean Vitamin D Values With Gender

Sex	Mean±SD	t value	P value
Male	37.4563±9.8108	0.045	0.964
Female	37.6271±18.28		

*SD-Standard deviation

Table 5 shows that mean (±SD) for male and female participants were 37.4563 (±9.8108) ng/ml and 37.6271(±18.28) ng/ml respectively and it was not significant (p=0.964).

DISCUSSION

The present study was conducted to look for association of serum Vitamin D levels with myopia in children and adolescents in the age group of 10 – 25 years. The mean age of the patients was found to be 19.44 years. The pick incidence of the disease was observed in the age group of 16 to 25 years (81%). Singh L et al also found similar results in their study with majority of the cases in age group of 19 – 21 years. Progression of myopia is more common in young adults than the school going children [20]. Time spent outdoor was found to be a protective factor for myopia [20].

The study shows that, 3.1% and 6.3% of the control (Non-myopia) population has deficient and insufficient serum Vitamin D concentration respectively whereas15.6% and 28.1% of the myopia cases have deficient and insufficient serum Vitamin D concentration respectively which is statistically significant with a p value of 0.008. Naveed S et al found association between myopia and serum vitamin D levels with high significance (p = 0.002)[25].

Logistic regression analysis (both adjusted and unadjusted) of association with myopia was done in the study. In the unadjusted model it was seen that the odds of having myopia decreased with increasing value of serum vitamin D concentration (OR= 0.904, 95% CI 0.848 – 0.963, P=0.002), and increased across categories of decreasing vitamin D status (OR=7.250, 95% CI 1.405 – 37.419 for vitamin D deficiency versus sufficiency). In the adjusted model, the odds of having myopia decreased with increasing value of serum vitamin D concentration (OR= 0.908, 95% CI 0.831 – 0.992, P=0.033). In analysis for association between vitamin D deficiency and myopia in a study done by Jung BJ, logistic regression analysis showed OR for myopia was 0.98 (95% confidence interval [CI], 0.97–0.98) before adjustment as 25(OH) D level increased by 1 ng/mL, and this association was not changed after adjustment (OR; 0.98, 95% CI, 0.98–0.99) [24]. Mean (±SD) serum vitamin D levels in myopia and

non-myopia are 31.2 (±9.8) ng/ml and 43.9 (±15.6) ng/ml respectively, which was statistically significant (p<0.0001) [26]. Study conducted by Tideman JW et al found similar results [27].

CONCLUSION

From the findings of this study, it can be concluded that young patients with myopia have lower serum Vitamin D level than normal healthy individuals. Therefore, serum Vitamin D level has the potential to be used as a prognostic marker in myopic individuals. We can draw an inference that with growing urbanization, the outdoor activities of children and adolescents has been considerably decreased leading to vitamin D deficiency with subsequent refractive errors mainly myopia. Significant research in this area is very limited in Assam, India. Therefore, this study was conducted to find an association between hypovitaminosis D and myopia among children and young adults in the tertiary care hospital catering mainly Assam and the neighbouring North eastern states. More studies are required in this region of India to corroborate the findings of this study.

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