

ORIGINAL ARTICLE

PREVALENCE OF VITAMIN-A DEFICIENCY & REFRACTIVE ERRORS IN PRIMARY SCHOOL-GOING CHILDREN

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ABSTRACT

Purpose: The objectives of the study were to assess refractive errors in primary school-going children; to critically analyze the need for supplementation of Vitamin A; and to children of low socioeconomic strata.

Methods: Students were examined from 2 primary schools. Visual acuity was tested using Snellen's chart, Pictogram & Landolt C chart. Detailed anterior and posterior segment examination was done using Binocular loop, Ophthalmoscope and Streak retinoscope.

Results: Total no of 560 children of age 3 to 13yr were screened from 2 primary schools. Statistically significant difference was found in the age of the study subject & presence of refractive errors. Percentage of students having Refractive error: myopia (29.64%) is the major cause of refractive error, followed by astigmatism (4.28%) hypermetropia (3.25%) and amblyopia (1.25%). Conclusion: It was observed that many children had high refractive error and were undiagnosed. The possible reason could be ignorance on the part of teachers and parents, even when the children have vision related complains. Also the children in the younger age-group lack the acumen to judge whether they can see clearly or not. Prevalence of Vitamin A deficiency appears reduced in urban areas.

Key words: Vitamin A deficiency, refractive error, primary school going children,

INTRODUCTION

According to the World Health Organization (WHO) "Approximately 250,000-500,000 children in developing countries become blind each year owing to Vitamin A deficiency, with the highest prevalence in Southeast Asia and Africa." ¹ Vitamin A is needed by the retina in the form of a specific metabolite, the light-absorbing molecule, Retinal, that is absolutely necessary for both low-light (scotopic) and colour vision. "Vitamin A" covers both a pre-formed vitamin, retinol, and a pro-vitamin, beta carotene, some of which is converted to retinol in the intestinal mucosa. ² Vitamin A also functions in a very different role, as an irreversibly oxidized form of retinol known as Retinoic acid, which is an important hormone-like growth factor for epithelial and other cells. It is the role of vitamin A in the visual cycle that we are concerned with in this study. ³

Vitamin A deficiency can be of two categories:

Primary and Secondary. Primary deficiency of the vitamin is due to its inadequate intake in the diet. In certain cases (especially in the developing countries) early weaning of a child can later lead to primary deficiency. Secondary vitamin A deficiency is the result of malabsorption disorders or a defect in

its metabolism. Poor eyesight is one of the first manifestations of Vitamin A deficiency. A severe deficiency leads to night-blindness, Bitot's spots, corneal xerosis and keratomalacia which is a major cause of blindness in India. There is a decline in clinical Vitamin A deficiency in under-five children in the country. This could perhaps be due to increase in access to health care, consequent reduction in severity and duration of common childhood morbidity due to infections. Data from NNMB surveys show that there has been substantial decline in prevalence of Bitot's spots. The NNMB micronutrient survey indicates that currently prevalence of Bitot's spots in preschool children is only 0.7% ⁴ prevalence of night blindness is less than 0.5 %.

Data from NNMB and ICMR surveys indicate that prevalence of Bitot's spots is less than 1%. Data from NNMB survey showed that prevalence of Bitot's spots is higher in children of illiterate mothers; prevalence of Bitot's spots is lowest in children from small families. ⁵ There are large inter-state variations in the prevalence of VAD among children. In the 1950s, prevalence of night blindness and Bitot's spots in pre-school children ranged between 5 per cent and 10 per cent in most states. The number of

children with vision problems has fallen below 10 per 1,000 children in states such as Gujarat and Punjab.⁶ Secondly, Refractive errors are the most commonly encountered ocular problems worldwide. In many a case, they go unnoticed, especially among children: owing to the fact that they are too young to even realise, let alone tell, that they are having difficulty in seeing clearly. What adds to the iceberg phenomenon of the disease was the fact that India is a developing nation, with a large population living below the poverty line. This results in a vast number of children who don't even know how to read. It were these children that formed the core interest- in our study.

The purpose of this study was to find out the efficacy vitamin A supplementation programme and to sensitize awareness of balanced diet in people of lower socioeconomic strata. And also to find out the refractive error in primary school going children and spread awareness of eye examination in them and parents to avoid childhood refractive amblyopia.

METHODOLOGY

Ethics: Study was conducted after a ethical clearance from ethical committee of our Institute (Dr. D.Y.Patil vidyapeeth) which follows Helsinki Declaration of 1975, as revised in 2000. Permission from school headmistress was obtained to conduct a study.

In this prospective study, a total number of 652 students from two primary schools in suburban area, including both the sexes, between 1 to 13 age group students were examined in mid-June-August 2015. All students were examined for both, Vitamin A deficiency and Refractive errors. Vitamin A deficiency was assessed by looking for specific signs and symptoms along with extra-ocular manifestations, as per proforma. Visual acuity was tested with Snellen's chart, Pictogram and Landolt C chart (for distant vision) Jaeger's chart (for near vision), anterior segment examination done with help of corneal loop and torch. Procedure for corneal examination with the help of Binocular loop and torch: Indistinct or blurred edges of the corneal light reflex (reflection of light from the cornea when illuminated) suggest that the corneal surface is not intact or is roughened, as occurs with a corneal abrasion or corneal xerosis. Posterior segment examination was done with Beta Heinz Direct Ophthalmoscope. Ametopic children underwent cycloplegic refraction with streak retinoscope and were prescribed glasses after post-mydratic test.

All data was documented and analysed with 'Statistical Package for Social Science' version 15(IBM). All data was analysed for quantitative measures.

RESULTS

A total of 560 children of age 3 years to 13 years were screened from two primary schools. Among 560 students, 215 students had refractive error and 345 students revealed emmetropia. Laterality of visual acuity is shown in Table 1

Table 1: Visual Acuity of Each Eye (n=560)

Visual Acuity	Right Eye	Left Eye
	No. (%)	No. (%)
6/6	372 (66.4)	351 (62.6)
6/9	84 (15.0)	93 (17.0)
6/12	51 (9.1)	62 (11.0)
6/18	27 (4.8)	30 (5.4)
6/24	14 (2.5)	12 (2.1)
6/36	7 (1.3)	6 (1.0)
6/60	5 (0.8)	6 (1.0)

Table 2: Association between Age of the Study Subject and Refractive Error

Age in years	Refractive Error		Total (%)
	Yes (%)	No (%)	
5	27 (27.55)	71 (72.45)	98 (100)
6	32 (32.32)	57(64.04)	89 (100)
7	9 (17.31)	43 (82.69)	52 (100)
8	36 (52.94)	32 (47.06)	68 (100)
a	36 (46.15)	42 (53.85)	78 (100)
10	14 (40.00)	21 (60.00)	35 (100)
11	40 (40.82%)	58 (59.18%)	98 (100%)
12	21 (50.00%)	21 (50.00%)	42 (100%)

$X^2 = 27.006$; $df=7$; p value = 0.0001, Highly significant

Statistically significant difference was found in the age of the study subject and presence of refractive error. Percentage of refractive error is increased with the increase in age group. (Table 2)

Table 3: Association between Gender of the Study Subject and Refractive Error

Gender	Refractive Error		Total
	Yes (%)	No (%)	
Male	117 (33.33)	189 (33.75)	306 (100)
Female	98 (32.56)	156 (28.00)	254 (100)
Total	215 (32.97)	345 (61.60)	560 (100)

$X^2 = 0.016$; $df=1$; p value = 0.899

Table 4: Distribution of Refractive Error

Refractive Error	No. (%)
Myopia	166 (29.64)
Hypermetropia	18 (3.25)
Astigmatism	24 (4.28)
Amblyopia	7 (1.25)

No statistically significant difference was found in the gender of the study subject and presence of refractive error. As shown in Table 3 $\chi^2 = 0.016$ with 1 df: p value = 0.899

As per shown in table no 4 myopia was the most common refractive error followed by astigmatism and hypermetropia

DISCUSSION

A total of 560 children were screened for vitamin A deficiency and refractive errors in two primary schools.

A complete ophthalmic examination of 560 children was then performed. Among them a significantly high percentage (33.42%) was suffering from refractive errors. The visual acuity testing was done with the help of Snellen's chart, Landolt C chart (for distant vision) and Jaeger's chart (for near vision). All the children diagnosed with any refractive error or ocular pathology was further referred for a detailed examination to the hospital. Those diagnosed with a refractive error were given a spectacle correction after cycloplegic refraction with appropriate correction. From Table 4 it was observed that a high percentage (215) out of 560 students, were diagnosed with refractive errors. Out of which 166 students were diagnosed with myopia. Factors that contributed to a high percentage of myopia within the study group includes- Poor socio-economic status, Undiagnosed case and Ignorance by parents/ teachers when the child complains of difficulty in seeing.

A study on refractive errors among school children in Kolkata by Das A, Dutta H, Bhaduri G, De Sarkar A, Sarkar K, Bannerjee M. their study shows close resemblance with our study There is an increase of prevalence of refractive errors with increase of age, but it is not statistically significant ($p > 0.05$). which in our study we found it statistically significant ($p < 0.001$) considering increase in axial length with increased age may be the reason for the myopic patients.⁷ with increasing age patient may have better perception of surrounding and reports well. There is also no significant difference of refractive errors between boys and girls. This is comparable to our study as per which of myopia (29.64%) is the major cause of refractive error, followed by astigmatism (4.28%) hypermetropia (3.25%) and amblyopia (1.25%).⁷ By Kawuma M, Mayeku R.⁸ They found that astigmatism is commonest followed by hyperopia and least common, Myopia, as refractive error. Our findings were the polar opposite of the above mentioned project- myopia being the most common condition. This reveals that there may be difference in types of refractive errors, but meticulous examination to find them has to be done in primary school-going children.

In the study, B.M. El-Bayoumy, A. Saad and A.H. Choudhury; Landolt broken ring chart and pin-hole were employed as the primary tools. We too utilized the same instruments- Landolt broken ring chart and Snellen's chart. The principal reason for this was that majority of children were too young to read. Others were poor in language skills and incapable of reading Hindi, Marathi and English Snellen's charts. We too concluded that myopia is the most commonly occurring refractive error among children; the majority being cases of school myopia.⁹ Gupta et al showed that overall prevalence of ocular morbidity in government and private schools did not show any statistical significant difference.¹⁰ In our study we too examined children from two schools- a private institution and a municipal school. Our observations were similar to the one stated formerly- there was no significant difference between the findings in the two kinds of educational set-ups. More importantly, in consistence with the study in Kolkata by Das et al⁷ my observations and calculations revealed that gender does not play a causal role in the development of refractive errors.

As per study of Murthhy et al.¹¹ there was an age-related shift in refractive error from hyperopia in young children (15.6% in 5-year-olds) toward myopia in older children (10.8% in 15-year-olds) as compared with our study. Through careful statistical analysis of the data collected, we deduced that the risk of developing myopia increases with age. Myopia existed in the same proportion as the aforementioned studies. Therefore, it would not be erroneous to say that a similar trend persists through the rest of the country Nazia Uzma et al¹² stated that the prevalence of refractive error was higher in the urban than the rural group. Increased literacy rate, duration of study hours and older age of the child were found to have contributed more to prevalence of myopia in the urban group. In the study 54% presented with refractive errors in the urban group and 3.2% students showed night-blindness as a sign of vitamin A deficiency.

Comparison with our study showed findings that were consistent to those of the aforementioned study. The percentage of children suffering from refractive errors was comparable. But there was no case of vitamin A deficiency in our study. The study was also conducted in suburban area as like our area. The area has been well covered by health-care centres and other medical facilities. Also due to urbanization and mass-coverage of the Vitamin A prophylaxis programme, there seems to be a significant decrease in vitamin A deficiency. We concluded that vitamin A deficiency varies from place to place.

Study by Chaturvedi S, Aggarwal OP.¹³ Trachoma (18%) was the most common ocular morbidity followed by vitamin A deficiency (10.6%), it revealed

that there are certain parts of India that are still tackling preventable diseases like Trachoma and Vitamin A deficiency. Vitamin A deficiency is one of the major deficiencies among the lower economic strata of India. In the fifties and sixties many of the states reported that blindness due to Vitamin A deficiency was one of the major causes of blindness in children below five years. A five-year long field trial conducted by NIN showed that if massive dose Vitamin A (200,000 units) was administered once in six months to children between one and three years of age, the incidence of corneal xerophthalmia is reduced by about 80 per cent¹⁴ In view of the serious nature of the problem of blindness due to Vitamin A deficiency, it was felt that urgent remedial measures in the form of massive dose Vitamin A supplementation covering the entire population of susceptible children should be undertaken. In 1970, the National Prophylaxis Programme against Nutritional Blindness was initiated as a centrally sponsored scheme. Under this scheme, all children between ages of one and three years were to be administered 200,000 IU of Vitamin A orally once in six months.¹⁵

This programme had been implemented in all the states and union territories during the last thirty-five years. The major bottleneck during the 1970s was lack of infrastructure at the peripheral level to ensure timely administration of the dose.¹⁶ In the 1980s there was considerable improvement in the infrastructure. The lack of adequate supply of Vitamin A, which came in the way of improved coverage, was also corrected. In an attempt to improve the coverage, especially of the first two doses, it was decided to link Vitamin A administration with the on-going immunization programme during the Eighth Plan period. Under the revised regimen a dose of 100,000 IU of Vitamin A was administered to all infants at nine months along with measles vaccine and a second dose of 200,000 IU was administered at 18 months of age along with booster dose of DPT and OPV. Subsequently, the children were to receive three 281 doses of 200,000 IU of Vitamin A every six months until 36 months of age.¹⁷ The reported coverage figures under the modified regimen indicate that there was some improvement in coverage with the first dose (50 –75 per cent). However, the coverage for subsequent doses was low. In an attempt to further widen the coverage, some states like Odisha linked administration of Vitamin A with the pulse polio immunization campaign. It is reported that the state took precautions to prevent overdosing by stopping Vitamin A administration in the preceding six months. The state reported improved coverage¹⁸. Following this report several states embarked on a similar exercise. Planning Commission, the Department of Family Welfare and the Indian Academy of Pediatrics stated that this strategy is inappropriate.¹⁹

During the campaign mode administration of Vitamin A, along with pulse polio, in Assam^{20 (21) (22)} in November 2001, deaths among children who were administered massive dose Vitamin A was reported. Some of these deaths could be coincidental where Vitamin A had been administered to ill children, but the possibility that some of the deaths could have been due to Vitamin A toxicity (either due to administration of higher dose or a massive dose Vitamin A administration earlier) cannot be ruled out.²³ The Tenth Five Year plan recommended that the second and subsequent doses of massive dose vitamin A may be administered biannually in the pre summer (April-May) and pre winter (Sept-Oct) period. This strategy was successfully put into operation in states like U.P with UNICEF²⁴ assistance and resulted in improved coverage for all the doses. In 2006-07, a policy decision has been taken to cover all children in the 9 month to 6 yr age group under the massive dose vitamin A programme. Clinical Vitamin A deficiency often coexists with other micronutrient deficiencies and hence, there is a need for broad-based dietary diversification programmes aimed at improving the overall micronutrient nutritional status of children.²⁵

WHO's goal²⁶ is the worldwide elimination of vitamin A deficiency and its tragic consequences, including blindness, disease and premature death. To successfully combat VAD, short-term interventions and proper infant feeding must be backed up by long-term sustainable solutions. The arsenal of nutritional "well-being weapons" includes a combination of breastfeeding and vitamin A supplementation²⁷ coupled with enduring solutions, such as promotion of vitamin A-rich diets and food fortification.²⁸ The basis for lifelong health begins in childhood. Vitamin A is a crucial component. Since breast milk is a natural source of vitamin A, promoting breastfeeding is the best way to protect babies from VAD.²⁹

CONCLUSION

The study was conducted in a municipal school and a private school. Myopia contributed to 29.64% refractive error being the commonest of the refractive errors. We observed that many children had high refractive error and were undiagnosed. The possible reason could be ignorance on the part of teachers and parents when the child complained about difficulty in seeing clearly. Also a child in the younger age-group lacks the acumen to judge whether he/she can see properly or not. Lack of proper nutrients and undernourishment culminate in refractive errors. All the children with the aforesaid complaints were sent for detailed ophthalmic examination, and correct power spectacles were prescribed. During screening of the children there were new cases of refractive errors of which few had a very high refractive error

and needed immediate correction and a few who had just developed myopia-school/simple myopia. The children with amblyopia were also detected and before it could progress into other ocular conditions it was corrected.

If we speculate the present scenario of our country, we will come to see that India has taken a giant leap forward in an attempt to improve the general health and well-being of the population. Through the decades, more and more emphasis has been laid on reducing the prevalence and incidence of the slow, silent killers- the deficiency disorders. The National Programme for Prevention of Nutritional Blindness-launched in 1970- bears testimony to the progress made by the health-care sector of India.

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