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Original Research Article

Prevalence of Myopia and Its Associated Risk Factors among School Children in Kollam- Kerala

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ABSTRACT

Background: Myopia, the most common type of refractive error, is a complex trait including both genetic and environmental factors. The prevalence's of myopia vary across populations of different regions and ethnicities. More time spent on near work, less time outdoors, higher educational level and parental history of myopia have been reported to increase the risk of myopia. Treatable refractive error is the major cause (33.3%) of the blindness in children. The prevalence of childhood blindness in India is 0.17%.
Aims and objective: To find the prevalence of Myopia and its associated risk factors among school children in a rural set up.
Study design: A cross sectional study was conducted by enrolling 300 children from a single school in a rural area.
Settings: Students studying in classes' fifth to tenth standard from a school in rural area in Kollam District, Kerala.
Materials and methods: Visual Acuity was tested using Snellen chart. In order to get information on influencing factors, the students were then interviewed separately using pre-tested and pre-designed interview schedule.
Statistics: A Stratified random sampling technique was applied for selecting students from each class and by using the formula for sample size calculation, a sample of 300 students has been selected by applying simple random sampling technique. Descriptive measures like mean and standard deviation were applied. To find the association between the various variables and Myopia, Chi square test was applied. One sample student's t-test was applied for finding the effect of age on Myopia. Those variables that found to be significant in Univariate analysis were used for Multivariate analysis. The P value for statistical significance was fixed at $P<0.05$.
Results and conclusion: The prevalence of myopia was found to be 44% and it was more for students who were at the age of 12 years. The prevalence was found to be more in girls. Myopia was found to be significantly associated with Age (P=0.000), reading hours per day (P=0.002), Computer hours per weekend (P=0.035), Reading hours per weekend (P=0.000), distance while watching TV (P= 0.025), distance while reading (P=0.003), Illumination while reading (P=0.009) and duration of sleep per day (P=0.001). In multivariate analysis, the occurrence of Myopia was statistically associated with age (OR=1.278, P=0.005) and duration of sleep (P=0.002). Age was the only factor found to be significant in both Univariate and Multivariate analysis. Those who spend more time in front of the Computer during weekends, those who had an unscientific way of reading and watching TV especially in dim light were at greater risk of developing Myopia. Age was found to be an indispensible risk factor for Myopia in the study. It is necessary to create awareness among children, as well as their parents about

the increasing prevalence of Myopia with advice to follow correct approach while using computer, watching TV and while reading.

Key Words: Myopia, Children etc.

INTRODUCTION

Myopia is the refractive anomaly of the eye in which the conjugate focus of the retina is at some finite point in front of the eye, when the eye is not accommodating. Myopia is derived from the term “muopia” which in Greek means to lose the eyes. It manifests itself as blurred distance vision, hence the popular term “nearsightedness”. Refractive error is one of the most common causes of visual impairment around the world. [1] The definition of visual impairment in the International Statistical classification of diseases, injuries, causes of death, 10th revision (ICD-10), H54, is based on “best-corrected” vision, i.e., Visual acuity obtained with the best possible refractive correction. [2] Although, the prevalence of myopia varies by the country, age and by ethnic group it is a major cause of visual impairment in both the developed and the developing world. [3] Myopia is a highly significant problem, not only because of its high prevalence, but also because it can contribute to visual morbidity and increase the risk for vision-threatening conditions. [4] Nearsightedness is a very common vision condition affecting nearly 30 percent of the U.S. population. Some research supports the theory that nearsightedness is hereditary. There is also growing evidence that it is influenced by the visual stress of too much close work. Generally, nearsightedness first occurs in school-age children. Because the eye continues to grow during childhood, it typically progresses until about age 20. [5] Myopia has emerged as a major health issue in East Asia, because of its increasingly high prevalence in the past few decades. This increased prevalence seems to be associated with increasing educational pressures, combined with life -style changes, which have reduced the time children, spend outside. India has an estimated of 320,000 blind children, more than any other country in the world. [6] The control of blindness in children is one of the priority areas of the World Health Organization's (WHO) "Vision 2020: the right to sight" program. This is a global initiative, which was launched by WHO in 1999 to eliminate avoidable blindness from worldwide by the Year 2020. [7]

In the age group 5-15 years, non-correction of refractive errors is due to several factors: the lack of screening, and the availability and affordability of refractive corrections are the most important. [2] In India uncorrected refractive errors are the most common cause of visual impairment and second major cause of avoidable blindness. School screening programmes have been an established part of the school health services since 1907 and remained universally recommended. [6] Although school vision screening programme is very successful in many states, still a significant number of school going children remain unidentified and the unmet need for correcting refractive errors in children appears to be significant. School myopia commences around 5-15 years of age and tends to stabilize in the late teens and is mainly thought to be idiopathic. [8] School children are a captive audience and can be reached more easily in comparison to general population. [6] The earliest survey conducted in India in the 1970's has shown a prevalence of myopia of 4.79% among the school children in Chandigarh. It was higher in urban population (6.9%) in comparison to rural population (2.77%). [9] In the study, conducted in 2001, the prevalence of myopia at an urban location (Delhi) was 7.45%, [10] and 4.1% at a rural location (Mahmoodnagar in Andhra Pradesh). [11] According to NPCB India report, in 2007 the prevalence of Myopia was 6.97% among school children in Punjab. In urban it was

9.97% and in rural it was 2.98%. [12] Another study conducted in 2015 revealed that the prevalence of Myopia was 13.1%. [13] The presence of refractive errors in school going children affects their physical, mental and behavioural development as well. [14] Early detection and correction of refractive errors result in a decrease in the number of school children with poor sight. [6] The high-school students have a high load of prolonged near-work during the high-school period during which little time is left for outdoor activities. Only 16% high school students of China have one hour of outdoor activity. Studies showed that a short duration of outdoor activities is, among other factors such as parental myopia, level of parental education and region of habitation, a major factor associated with the prevalence and incidence of myopia in children. [15] Risk of Myopia is increased particularly in those children who are having a reading habit, increased indoor activities and family history. The risk of development of Myopia further increases with the habit of reading in supine position. [16]

The objective of the study is to find the prevalence of Myopia and its associated risk factors among school children in a rural set up.

MATERIALS AND METHODS

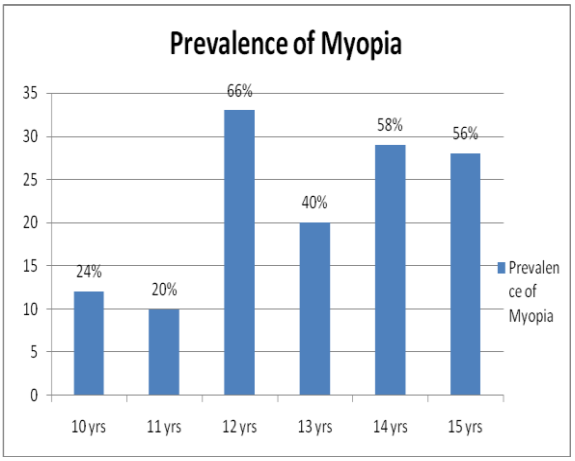
This was a cross sectional study with the aim of enrolling children studying in a single school from a rural area. Students of 5^{th} to 10^{th} standard were selected. Stratified random sampling techniques were applied by considering one class as one stratum. Total of 300 students were selected by applying the formula for sample size calculation ($n=4pq/L^2$). In order to have same number of students from each class 50 students were selected by fixing same number of girls and boys from each class. Using the roll book, students from each class were selected by applying simple random sampling techniques. The study was carried out from October 2014 to December 2014. The permission was obtained from the school Principal, informed written consent was obtained from the parents and assent obtained from the students. A pre-designed and pre-tested interview schedule was administered to interview the study participants to elicit the information on individual characteristics like sex, standard in which the student is studying, time spent for reading, time of continuous reading, reading distance, reading position, source of light in reading area, mode of spending leisure time, time spent for outdoor activities, duration of sleep and family history of Myopia. The questions were asked in local vernacular language, that is, in Malayalam that was understood by all the students and the answers were recorded in English.

Visual Acuity was tested using Snellen's chart. Students were placed 6m from the chart and were asked to read the chart. Each eye was tested separately. The definition of Myopia used in the study was - those who were having distant visual acuity less than 6/6 were considered as myopic. [14] Students were grouped according to this criterion.

Statistical analysis

The data collected was compiled, coded and entered in Microsoft Excel 2010 Spread sheet and was analyzed using IBM SPSS Version 20. Continuous variables were summarized using means and standard deviation and independent sample t-test was done for statistical significance. Categorical variables were summarized as proportions and Pearson Chi-square test was used to assess statistical significance. Univariate and Logistic Regression analysis were performed to calculate crude and adjusted odds ratio with 95 % confidence intervals to rule out the effect of chance. Prevalence of Myopia was expressed in percentage. Odds ratio and its 95% confidence interval were calculated. The association was assessed by using the Pearson Chi-square test. Conventionally in all statistical tests applied P value less than 0.05 is considered as statistically significant.

RESULTS



Graph No.1

The prevalence of Myopia was found to be 44% (132 out 300). The prevalence was more for students who were at the age of 12 years, which is 66% and least for students at the age of 11 years, which is 20%.

The mean age of the students examined in the study was 12.5 ± 0.19 years (range of 10-15 years). The prevalence of Myopia was found to be 47% (71 out of 150) for girls, which was more than that of the boys 41% (61 out 150). Prevalence of Myopia among children stratified by gender is represented in Table: 1

Table No.1: Prevalence of Myopia among students with respect to Gender

Gender	Prevalence of Myopia (%)
Boys	61 (40.6)
Girls	71 (47.3)

Table No. 2: Association of the risk factors with Myopia

Variable under study	Myopic	Non Myopic	P value
Total time spend for reading			
< 2hrs	55	93	0.134
2-4 hrs	67	66	
4-7 hrs	9	8	
Greater than 7 hours	1	1	
Continuously read for more than 30 minutes			
Yes	68	75	0.237
No	64	93	
Reading distance			
Less than 30 cm	68	81	0.57
Greater than30 cm	64	87	
Reading position			
Lying	8	18	0.221
Sitting	119	147	
Walking	5	3	
Reading hours per day			
< 1 hour	33	44	0.002
1-2 hour	64	56	
>3 hours	15	12	
Nil	20	56	
Computer hours per weekend			
2-3 hours	15	13	0.035
3-4 hours	7	2	
>4 hours	0	4	
Nil	110	149	
Reading hours per weekend			
2-3 hours	54	74	0.000
3-4 hours	47	27	
>4 hours	4	5	
Nil	27	62	
Distance while watching TV			
Less than 30 cm	34	53	0.025
More than30 cm	93	97	
Nil	5	18	
Distance while reading			
Less than 30 cm	60	54	0.003
More than30 cm	50	58	
Nil	22	56	
Illumination while reading			
Dim	23	24	0.009
Bright	89	93	
Nil	20	51	
Duration of Sleep			
Less than 6 hour	6	21	0.001
6-7 hours	54	60	
7-8 hours	30	58	
Greater than 8 hours	42	29	

Chi-square test was performed to find the association between myopia and various factors considered in the study; the factors like gender, family history of Myopia, total time spent for reading, continuous reading for more than 30 minutes, reading distance, reading position, source of light and total time spent for outdoor activities were not found to have significant association with the occurrence of Myopia. Myopia was found to be significantly associated with reading hours per day (P=0.002); computer hours per weekend (P= 0.035); reading hours per weekend (P=0.000); distance while watching TV (P=0.025); distance while reading (P= 0.003); illumination while reading (P= 0.009) and duration of sleep per day (P= 0.001). The relationship of myopia with other risk factors are shown in the following table (Table No. 2)

Since age is a continuous variable in the study, to find the effect of age on myopia; independent sample t-test was applied. There exists a statistically significant relation between age and the occurrence of Myopia, P<0.0001- Also a positive correlation exists between age and myopia, r=0.244 and the relation was found to be statistically significant, P<0.0001.

Table No. 3: Association (Univariate Analysis) between the prevalence of Myopia and associated factors among children

Variable	P value	Odds	95% Confidence Interval	
Age*	0.0000	1.07	1.04	1.11
Gender	0.245	0.76	0.48	1.20
Standard of study	0.000	0.93	0.90	0.96
Reading distance	0.570	0.88	0.56	1.38
Reading hrs/day	0.002	1.12	1.06	1.19
Reading hrs/weekend	0.000	1.14	1.07	1.22
Distance while watching TV	0.025	1.13	1.03	1.23
Distance while reading	0.003	1.08	1.01	1.17
Continuous reading for more than 30 minutes	0.237	1.32	0.83	2.08
Total time spent for reading	0.134	1.11	1.01	1.21
Reading position	0.221	1.16	0.98	1.38
Source of light	0.906	1.00	0.94	1.08
TV hours in a day	0.524	1.05	0.98	1.13
Computer hour per day	0.142	1.04	0.94	1.15
Mobile hour per day	0.102	1.09	1.01	1.17
TV hours per weekend	0.200	1.05	0.98	1.12
Computer hours per weekend	0.035	1.04	0.94	1.15
Mobile phone hrs per weekend	0.304	1.06	0.98	1.15
Distance while watching computer	0.268	1.07	0.96	1.18
Distance while using mobile phones	0.218	1.07	0.99	1.16
Illumination while watching TV	0.176	1.09	1.00	1.19
Illumination for watching computer	0.304	1.06	0.97	1.15
Illumination for watching mobile phones	0.194	1.06	0.99	1.13
Illumination while reading	0.009	1.11	1.04	1.18
Total time spent for outdoor activities	0.127	1.01	0.95	1.07
Duration of sleep	0.001	1.07	1.01	1.14
Family history of myopia in father	0.519	1.18	0.71	1.96
Family history of myopia in mother	0.417	0.80	0.46	1.38
Family history of myopia in siblings	0.207	1.69	0.74	3.86

In Univariate Analysis, prevalence of Myopia was found to be associated with age (OR=1.276), Reading hours per day (OR= 1.2435), Reading hours per weekend (OR= 1.2461), distance while watching TV (OR=1.1665), distance while reading (OR= 1.1354), illumination while reading (OR= 1.1936), duration of sleep (OR=1.1433), total time spent for reading (OR=1.11), usage of mobile phone in a day (OR= 1.09) and illumination while watching TV (OR=1.09). Students who were reading one to two hours and more than 3 hours per day were at higher risk of developing Myopia. Those who kept less than 30cm distance while reading (OR=1.1354) and while watching TV (OR= 1.1665) were found to be at higher risk of developing Myopia. Students who use dim light while reading were also at a greater risk of myopia. Those variables found to be significant in Univariate analysis were included in multivariate analysis. Table No.3 shows the relationship of Myopia with other variables in Univariate analysis.

Multivariate analysis, (Binary logistic regression using Enter method) with the prevalence of myopia as the dependent variable and factors which were significantly associated with myopia prevalence in the Univariate analysis, as independent variables, revealed that the prevalence of myopia remained to be statistically associated with age (OR=1.278, P= 0.005). Duration of sleep was found to be significant (P= 0.002) but Odds ratio was not significant in multivariate. The rest of the variables that was found to be significant in Univariate analysis were not significant in multivariate analysis. Family history was nevertheless significant in Univariate as well as in multivariate analysis. The relationship of myopia with various factors in multivariate analysis is represented in Table No.4

Age is the only factor which was found to be significant in Univariate as well as multivariate analysis. Those who find time for reading in a day (P=0.002, OR=1.12) and in weekends (P=0.000, OR= 1.14) were at higher risk of developing myopia in Univariate analysis. But on applying binary logistic regression, it was not significant after adjustment as shown in Table no.4. Those who kept less than 30cm distance while watching television (P=0.025, OR= 1.13) and while reading (P= 0.003, OR= 1.08) were having higher chance of getting myopia but this was not found to be significant in multivariate analysis (Table no.4).

Table No.4: Relationship of Myopia with various factors in Multivariate analysis

Variables	P-value	Odds Ratio	Confidence Interval (95%)
Age	0.005	1.278	(1.077, 1.517)
Reading hours per day	0.31		
Reading hours< 1 hour	0.227	0.416	(0.1, 1.727)
Reading hours 1-2 hrs	0.921	0.945	(0.31,2.882)
Reading hours > 3 hrs	0.694	1.223	(0.449, 3.332)
Reading hours weekend	0.367		
Reading hours in weekend for 2-3 hours	0.892	0.886	(0.154, 5.111)
Reading hours in weekend for 3-4 hours	0.9	0.906	(0.197, 4.174)
Reading more than 4 hours in weekends	0.538	1.612	(0.352, 7.379)
Distance while watching TV	0.159	-	-
Distance while watching TV less than 30 cm	0.116	0.404	(0.13, 1.251)
Distance while watching TV greater than 30 cm	0.166	0.644	(0.3461,1.201)
Distance while reading	0.487	-	-
Distance while reading less than 30 cm	0.875	1.121	(0.268, 4.684)
Distance while reading greater than 30 cm	0.23	1.474	(0.776, 2.802)
Illumination while reading	0.983	-	-
Duration of Sleep per day	0.002	-	-
Sleep less than 6 hrs	0.001	0.15	(0.05,0.455)
Sleep for 6-7 hrs	0.005	0.36	(0.176,0.737)
Sleep 7-8 hrs	0.006	0.368	(0.18, 0.751)

Univariate analysis showed that students who played games in mobile phones were at relatively higher risk of developing myopia (OR=1.09, 95%CI- 1.01, 1.17) but this significance was lost on multivariate analysis. Illumination while watching TV (P=0.176, OR= 1.09, 95%CI- 1.00, 1.19) and while reading (P=0.009, OR= 1.11, 95%CI- 1.04, 1.18); were found to have significant risk in Univariate analysis but the risk was not significant in multivariate analysis after adjustment. Duration of sleep was significantly associated (P= 0.001) with myopia, the crude Odds ratio was being 1.07 (95%CI- 1.01, 1.14). In multivariate analysis, however, the adjusted Odds ratio was not significant.

DISCUSSION

The aim of the present study was to evaluate the prevalence of myopia and its possible risk factors in school going children in a rural setting in Kerala. The prevalence of myopia in the present study was 44% and was found to be more among the children of 12 years of age. In a study by Nitin Batra from Punjab, [12] the prevalence of myopia was 6.97%. Compared to this study, the prevalence is more in the present study probably because the quoted study is

from Punjab and the life style factors varies between the two states.

In another study by Ishfaq Ahmed, [17] it was mentioned that the prevalence of myopia was 4.74 %, which is again less than the present study, probably the reason being that it had sampled entire Srinagar city in Kashmir, while the present study was restricted to only one school in rural area.

In a study Sambudda Ghosh, [14] the prevalence of myopia was seen to be 11.9%. Visual Acuity of less than 6/6 at least in one eye was 14.7% which is again less than that of the present study.

The presence of myopia was significantly associated with age in the present study, which is the only factor that was found to be significant both in Univariate and Multivariate analysis. Most of the students were found to myopic at the age of 10 and 11 years. Students at the age of 11 years were found to have more risk of Myopia (OR= 1.278, 95% CI= 1.077, 1.517). In a study in Southern India, [18] prevalence of myopia was significantly higher among children 10 years of age and above. The quoted study was also done in South India among school children. In another study in Hong Kong, [19] prevalence of myopia among school children was correlated positively with older age, with highest risk in children aged 11 years (OR=2.27). In the present study also, there exists a significantly positive correlation between age and occurrence of myopia (P<0.0001). Again in other studies, [17, 20,21] increasing age was associated with the increased risk of having myopia among school children. As seen from studies, [20] done in Ejina, China*;* Beijing, [21] India, [17,18] and Hong Kong, [19] it is clear that irrespective of race, ethnicity and region, the prevalence of myopia is strongly associated with increasing age.

The prevalence of Myopia was more for girls (47%) than boys (41%) but it was not significantly associated with gender (P= 0.245, OR=0.76) in the present study. In a study from Kashmir, [17] it was seen that girl students had more risk of myopia than boys (OR= 1.52). It was due to the fact that girls usually restricted their activities to inside the house and the outdoor activities like games, jogging etc were mainly undertaken by the boys. The religious and cultural factors prevailing in Kashmir could have been the reason for this significance. But in Kerala, the cultural factors do not support this significance.

The students who spent 2-4 hours and more than 4 hours for reading in a day were found to be more myopic than those who spent lesser hours reading, but this difference was not found to be significant. Another study, [13] showed a positive association between presence of myopia and the students who study or read for more than 5 hours per day. The quoted study was done in an urban school in Delhi and Delhi being the epicentre of education, more competitive studies exist among students and hence the students there may be more hardworking than those residing in rural areas, where students might not spend most of their time reading.

Continuously reading for more than 30 minutes and the reading distance less than 30cm were not significantly associated with myopia in the present study. In a study, [16] done among urban female school students in Surat, close reading at a distance less than 30 cm and continuous reading for more than 30 minutes and in low illumination adds upon the progression of Myopia. Females were more interested to be active in indoor activities in the quoted study in the urban setup. However, the present study was done in a rural setting which might be the reason why the significance in gender difference was not found. In another study, [22] done in Australia, it was seen that near work such as close reading distance less than 30 cm and continuous reading for more than 30 minutes independently increased the odds of having myopia. In the present study, reading habit as such may not be very pronounced for the students residing in a rural area whereas the quoted study was done in a developed country where the students may

have the habit of reading for pleasure. Hours spent for reading during weekends was found to be the significant risk factor for myopia in the present study. Those who spend more than 3 hours for reading were at a greater risk of developing myopia in univariate analysis P= <0.0001, OR= (1.07, 1.22). Similar results were found in the quoted study also.

Though in a study by Basu M, [16] it was mentioned that risk of development of myopia further increased with the habit of reading in supine position, it was not so in our study . This could be due to the fact that in our study, majority of the children would have had the habit of sitting while reading and hence reading position was not found to be associated with myopia.

Mode of spending leisure time in a day like watching TV, using computers, mobile phones and reading were all considered as indoor activities. Time spent for reading was significantly associated with Myopia (P=0.002, OR=1.12) and those who play games in mobile phones were at greater risk of developing myopia (OR=1.09, 95% CI= 1.01, 1.17) in the present study. In a study, [13] done in Delhi, positive association of presence of myopia was observed for children studying or reading for more than 5 hrs per day (P<0.001), watching television for more than 2 hrs per day (P<0.001) and playing with computer/video/mobile games (P<0.001). In both the studies, it was seen that children who spent leisure time in indoor activities were at a higher risk of developing myopia irrespective of the place they were residing at- urban or rural.

Duration of sleep per day was significantly associated with the occurrence of myopia in the present study. Those who slept for more than 8 hours per day were at a greater risk of developing myopia. In a study by Yanong Gong, [23] significant association between myopia and hours of sleeping were found in both Univariate (OR=2.05, P<0.001) and Multivariate analysis (OR=1.94, P<0.001). It was also found that children who slept for shorter period of time had significantly more myopic refraction (OR=4.07). In another study done among adolescents in Korea, [24] it was found that the adjusted odds ratio for myopia was decreased in those with more than 9 hours of sleep, when compared to those with less than 5 hours of sleep, that is, an inverse relationship between sleep duration and myopia was found. In the present study, since most of the students were hard working and outdoor activities were kept to a minimum; other than sleep, no further rest was there for the eyes.

Total time spent for outdoor activities was not found to be significantly associated with myopia in the present study. In a study by Guo.K, [20] also, prevalence of high myopia was not associated with time spent in outdoor activities. However, in another study, [13] an inverse association with outdoor activities or playing was observed; with children playing more than 2 hours in a day. In the present study, students who spend more than 2 hours for outdoor activities were comparatively less.

Family history of myopia in first and second degree relatives was not associated with Myopia in the present study. In a study done by Rohit Saxena, [13] a positive association of myopia with family history was found. In another study, [16] it was found that the risk of myopia increased in those children who had a family history. Both the quoted studies were done in an urban population in India, where their parents may be educated, working, and lead life in urban setup. In the present study, which was done in a rural setting, most of the parents were farmers, labourers and lead life in rural setup. This might be the reason why family history did not show any significance in the present study.

CONCLUSIONS

Screening of children for refractive errors should be conducted at community level and integrated into school health programmes, accompanied by education and awareness campaigns to ensure that the corrections are used and cultural barriers to compliance are addressed and removed.

REFERENCES

1. Dandona R, Dandona L, Refractive Error blindness; Bull World Health Organ;2001; 79: 237-243.
2. Serge Resnikoff, Donatella Pascolini, Silvio P Mariotti, etal, Global Magnitude of Visual impairment caused by uncorrected refractive errors in 2004, Bulletin of World Health Organisation.
3. Prof.Ian G Morgan, Prof.Kyoko Ohno Matsui, Prof Seang-Mei.Saw, MYOPIA, The LANCET, Volume 379, No.9827, P:1739-1748, May 2012.
4. Optometric Clinical Practice guideline, Care of patient with Myopia, American Optometric Association, Healthy people 2010 Vision.
5. American Optometric Association, Myopia (Near Sightedness).
6. Harpal Singh, VK Saini, Akhilesh Yadav, etal, Refractive Errors in Scool Going Children -Data from a School screening survey programme, National Journal of Community Medicine, Volume 4, Issue 1, Jan-Mar 2013.
7. World Health Organization, Global initiatives for the elimination of avoidable blindness. WHO/PBL/97.61. Geneva: WHO; 1997.
8. Rohit Saxena, Praveen Vasist, Vimala Menon, Is Myopia a public Health Problem in India, Indian Journal of Community Medicine, 2013, April-June; 38(2) ;83-85.
9. Jain IS, Jain S, Mohan K, The Epidemiology of High Myopia; Changing trends, Indian J Ophthalmol. 1983; 31:723-728[Pubmed].
10. Murthy GV, Gupta SK, Ellwein LB, etal, Refractive Error in Children in an urban population in New Delhi, Invest Ophthalmol Vis Sci. 2002;L13:623-31[Pubmed].
11. Dandona R, Dandona L, Srinivas M, etal. Refractive Error in Children in a rural population in India, Invest Optalmol Vis Sci.2002; 43: 615-622.
12. Dr.Nitin Batra, Dr.Dhawal KAusal, Dr.Amitoj Singh Gill, Refractive errors in School Children. A review from Punjab; NPCB India, Volume: 1, No: 4, October-December 2007.
13. Rohit Saxena, Praveen Vashist, Radika Tandon, etal, Prevalence of Myopia and its risk factors in Urban School Children in Delhi: The North India Myopia Study (NIM Study),PLOS ONE 10(2): e 0117349, 2015.
14. Sambudda Ghosh, Udayaditya Mukhopadhyay, Dipankar Maji, etal; Visual impairment in urban school children of low-income families in Kolkata, India; Indian J Public Health 2012;56:2,163-167.
15. LiJuanwu, Qishnag You, Jia Li Duan, etal, Prevalene and Associated factors of Myopic in High School students in Beijing; PLOS One March 24, V.10(3); 2015 e0120764.
16. Basu M, Das P, Pal R, etal, Spectrum of Visual Impairment among urban female school students of Surat, Indian Journal Ophthalmol 2011, 59(6); 475-479.
17. Ishfaq Amed, Seema Main, Syed Mudasir, etal, Prevalence of Myopia in students of Srinagar City of Kashmir, India. International Journal of Health Sciences (Int J Health Sci (Qassim) 2008 Jan; 2(1):77-81.
18. V Kalikivayi, T J Naduvilath, A k Bansal, etal, Visula impairment in School Children in Southern India, Indian Journal of Ophtalmology; year 1997; Volume:45,Issue 2.Pg 129-134.
19. Dorothy S.P Fan, Dennis S C Lam, Robert F Lam, etal, Prevalence, Incidence and Progression of Myopia of School Children in Hong Kong, Clinical and Epidemiologic Research, IOVS; April 2004, Volume 45, Issue 4 .
20. Guo. K, Yang DY, Wan Y, etal, Prevalence of myopia in school children eye study; Invest Ophthalmol Vis sa, 2015 jan 27.
21. You QS, Wu LJ, Duan JL, et al, Prevalence of Myopia in School Children in greater Beijing: the Beijing Childhood Eye Study. Acta Ptalmol.2014 Aug: 92 (5): e 398-406. Epub 2013 Oct 28.
22. IPJM Saw SM, Rose KA, etal, Role of near work in Myopia: findings in a sample of Australia School Children, Invest Ophthalmol Vis Sci. 2008 Jul; 49(7): 2903-10.
23. Yanong Gong, Xiulan Zhang, Dongua Tian, etal, Parental Myopia, near work, hours of sleep and myopia in Chinese children, Health, Vol:6, No.1, 64-70(2014).
24. Dongyun Jee, Ian G Morgan, Eunchul Kim, Inverse relationship between sleep duration and Myopia; Acta Ophthalmologica, Online: 1 June 2015, 10.1111/aos.12776.

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