Prevalence of Myopia in Students of Srinagar City of Kashmir, India

Ishfaq Ahmed[1], Seema Mian[2], Syed Mudasir[3] and K. I. Andrabi[4]
[1,4]Department of Biotechnology, University of Kashmir
[2]Mobile Ophthalmic Unit, Health Services, Kashmir
[3]Sher-i-Kashmir Institute Medical Sciences, Srinagar

Abstract:

Background: Myopia is a common ocular disorder. Prevalence data with regard to myopia is scarce in India and almost non-existent in Kashmir.

Objective: To determine the prevalence of myopia in Srinagar City and to evaluate risk factors associated with the disease.

Methods: 38 schools in the Srinagar were selected randomly and students were examined by our optometrist team. Children with refractive error of -0.25 D to -5.9 D were considered myopic, while those with -6 D and above were considered high myopic.

Statistical analysis used: $\chi 2$ Tests were used as appropriate to test whether potential risk factors were significantly associated with myopia. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated for risk factors that were independently associated with myopia in this population.

Results: A total of 4,360 students of mean age 12.11 (95% confidence interval [CI] = 11.99 – 12.22: range, 7-18) participated in the study. Myopia was found in 4.74% students. Increasing age was associated with the increased risk of having myopia. Girl students were more likely to have myopia than boys (OR = 1.52). The prevalence of myopia among girls was more than that of boys. Students from low socioeconomic conditions were having higher prevalence of myopia than their counterparts from higher socioeconomic counterparts.

Conclusion: Reduced vision because of myopia is an important health problem in students in Srinagar City. Most of these students do not have the necessary correction spectacles. Effective strategies are needed to eliminate the cause of a significant visual problem.

Keywords: Myopia, Prevalence, Kashmiri population.

Correspondence:
Prof. K. I. Andrabi
Head, Department of Biotechnology
University of Kashmir, Srinagar
E-mail: andrabik@kashmiruniversity.net

Introduction

Myopia is the most common eye disorder and is significant ocular health problem associated with the increased risk of visual loss around the world [1]. The prevalence of myopia varies by country and by ethnic group, reaching as high as 70-90% in some Asian populations [2, 3]. Near epidemic levels of myopia (up to 80%) have been reported in countries such as Hong Kong [4-7], Taiwan [8, 9], Singapore [10-12] and Japan [13]. In Europe and America, its prevalence varies between 30-40%, while in Africa 10-20% of the population is affected [14]. Myopia affects 25% of the population in United States [15]. Myopia has been associated with socioeconomic status, level and length of education, parental myopia, and the exposure to near work [16, 18-20]. A higher prevalence of myopia would, therefore, be expected in urban school students than in rural primary school students.

This study attempted to measure the prevalence of myopia leading to visual acuity of worse than 6/12 in either eye in students of Srinagar City (India) and to evaluate factors associated with myopia in students in Srinagar.

Subjects and Methods

A school and college based prevalence survey on myopia was organized in Srinagar. Approval from the Director, Health Services, Government of Jammu & Kashmir and Ethics Committee of University of Kashmir was sought before the commencement of the survey. The study population included school children grades 1 to 12 and college going students. A total of 38 institutions, both public and private, were visited. Intent letters were send to school and college principals detailing the study objectives and procedures. Written consents were obtained from college going students and the parents of school going students before the ophthalmic examinations. Non-Kashmiri subjects and the ones diagnosed with other ocular diseases such as amblyopia, squint or cataract were excluded.

Subjects were encouraged to narrate all the details relevant to this study. This included age, history of any other ocular disease, net income at home and information regarding close work. In case of school going students, the personal records of students were checked where required.

All examinations were conducted in the schools during school hours by optometrists from the Ophthalmic Mobile Unit, Health Services, Kashmir. Examinations included best-corrected distant visual acuity testing, retinoscopy and cycloplegic autorefraction. The distant visual acuity of each eye was measured using Snellen's E-chart at 6 m with standard lighting. Cycloplegia was achieved using 1 drop of combined 0.5% phenylephrine and 0.8% tropicamide eye drops (Ophthoremedies, Allahabad, India) instilled three times in the inferior conjunctiva cul-de-sac, at intervals of 15 minutes. A line on chart was accepted as being read if the direction of more than half the optotypes had been identified correctly. If the VA was below 6/12 in one or both eyes, a pinhole test was performed. Using a torch and direct ophthalmoscopy, the ophthalmologist inspected all the students' eyes for abnormalities of position and motility, the anterior segment, the optic disc, and the macula. If a diagnosis could not be established through inspection, thorough eye examination including bimicroscopy, indirect ophthalmoscopy and examination of fundus with +20 D and +78 D lens on slit lamp was done at the clinic of our ophthalmologist. Mild, moderate and severe myopia was defined as -0.25 to -2.99 D, -3.00 to -5.99 D, and -6.00 D or more, respectively.

Results

A total of 4,360 students from 38 institutions of mean age 12.11 (95% confidence interval [CI] = 11.99 – 12.22: range, 7-21) participated in the study. The mean spherical equivalent refraction (SER) was 0.93 D in the right eye (SD = 0.48: range -0.25 to -2.15), and 0.87 in the left eye (SD = 0.34: range -0.25 to -1.35). 207 students (4.74%) were found to have myopia out of which 141 (3.23%) were girls and 66 (1.51%) were boys. High myopia was found in 6 students (0.13%) (Table 1).

Table 1. Prevalence of myopia in students in Srinagar

Age Group	Total Tested	Boys	Girls	Total Myopic	Myopic Boys	Myopic Girls	High Myopic	Mean Power of Lens	
								Right Eye	Left Eye
Up to 7	491	294	197	6	1	5	0	0.91	0.91
7 to 8	406	209	197	2	0	2	0	0.62	0.62
8 to 9	357	230	127	21	12	9	1	2.15	1.35
9 to 10	420	213	207	14	6	8	0	0.94	0.89
10 to 11	383	234	149	20	11	9	1	0.65	0.6
11 to 12	368	227	141	27	17	10	0	1.02	0.98
12 to 13	339	167	172	18	5	13	1	0.84	0.95
13 to 14	330	163	167	19	10	9	2	0.94	0.88
14 to 15	325	41	284	13	1	12	1	1.17	1.25
15 to 16	172	37	135	9	3	6	0	1.33	1.33
16 to 18	403	0	403	20	0	20	0	0.25	0.25
Above 18	366	0	366	38	0	38	0	0.44	0.44
Total	4360	1815	2545	207	66	141	6		

The increased prevalence of myopia was evident. While the prevalence was only 3.76% in the age group of 6-10, it was 4.9% and 6.16% in age groups of 11-15 and 16-22, respectively (Table 2).

Girls on average were more myopic than boys. They were 1.52 times more likely to have myopia than boys. The prevalence of myopia among girls was 5.54% compared with 3.6% in boys (Table 3).

Socioeconomic conditions had an impact on the prevalence of myopia. While only 3.23% students from medium and high socioeconomic strata had myopia, it was about three times more in students from low socioeconomic strata (8.60%) (Table 4).

Table 2. Relationship between age and prevalence of myopia

Age Group	Subjects (n)	Affected	Prevalence (%)	P
6 – 10	1674	63	3.76	< 0.01
11 – 15	1745	86	4.9	
16- 22	941	58	6.16	

Table 3. Relationship between gender and prevalence of myopia

Gender	Subjects	Affected	Prevalence (%)	
Boys	1815	66	3.6	OR= 1.52 P< 0.004
Girls	2545	141	5.54	
Total	4360	207	4.74	

Table 4. Relationship between socioeconomic strata and prevalence of myopia

Standard of Living	Subjects (n)	Affected	Boys	Girls	Prevalence	OR = 3.09
High	2837	76	26	50	2.67 %	P < 0.00
Low	1523	131	40	91	8.60%	95% CI
Total	4360	207	66	141		= 2.56- 3.42

Discussion

Myopia is a most common human disorder with a considerable economic and health impact. An increasing trend in the prevalence rates of myopia has registered a renewed interest in myopia as a public health problem in Asia and other developed countries [21-25]. The pattern of geographical distribution of myopia has also become more apparent in recent years with prevalence rates of myopia being the highest in urban areas of Asia such as Hong Kong, Taiwan and Singapore, and the lowest in predominantly agricultural areas in non-Asian countries. This interesting phenomenon may arise if there are selective environmental and specific hereditary factors in urban Asian areas, which may lead to high prevalence rates of myopia. Near work is one of the most frequently cited risk factor for myopia, and several observations support this hypothesis. The prevalence rates of myopia may have increased over the past 10 to 20 years in Asia [21 ,22]. This possible rise cannot be attributed to genes, as the genetic pool has not changed dramatically over this short period. Environmental factors such as progressively more competitive education system may have had an increasing impact in recent years. Moreover, environmental factors such as educational level, occupation and individual income have been shown to associate with the prevalence of myopia [3, 26]. Females and people with low socioeconomic conditions are considered at high risk of myopia [25, 27].

To our knowledge, this is the first study examining the prevalence of myopia and the potential risk factors in students in Kashmiri urban population. Our results show the prevalence of myopia to be 4.74% among students from different academic and socioeconomic backgrounds in Srinagar. Compared to the prevalence of myopia in students from other Asian countries, like Hong Kong [27], which stands at 80%, this may not be worrisome, but compared to the prevalence of 2.81% in Andhra Pradesh, India [28], it seems to be significant. A positive correlation between the prevalence of myopia with age and the increasing prevalence of myopia with higher studies lends a strong support to close work theory in myopia development because in higher classes students tend to spend more time on studies. This goes with the fact that girl students were 1.5 times more likely to have myopia than their male counterparts. It might possibly be because girl students are more likely to be with books, television or computers than their male counterparts. A higher prevalence of myopia in students with low socioeconomic background was also observed in conformity with the trend in other populations. Students belonging to low social strata are disadvantaged with regard to health care access, including eye care, mainly for economic reasons.

Acknowledgements

We are thankful to Dr. Tariq Rashid Jan from the Department of Statistics, University of Kashmir, for helping in data analysis.

References

[1] Fredrick DR. Myopia. BMJ. 2002; 1195-9.
[2] Curtin BJ. The Myopias: Basic Science and Clinical Management. Harper & Rowe, New York. 1985; pp. 237-45.
[3] Leibowtiz HM, Krueger DF, Maunder LR, Milton RC, Kini MM, Kahn HA, et al. The framingham eye study monograph: An ophthalmological and epidemiological study of cataract, glaucoma, diabetic retinopathy, macular degeneration, and visual acuity in a general population of 2,631 adults, 1973-1975. Surv Ophthalmol. 1980; 24: 472-9.
[4] Lam CSY, Goh WSH. The incidence of refractive errors among school children in Hong Kong and its relationship with the optical components. Clin Exp Optom. 1991; 74: 97-103.

[5] Yap M, Wu M, Wang SH, Lee FL, Liu ZM. Environmental factors and refractive error in Chinese schoolchildren. Clin Exp Optom. 1993b; 77: 8-14.
[6] Edwards MH. The development of myopia in Hong Kong children between the ages of 7 and 12 years: A five-year longitudinal study. Ophthal Physiol Opt. 1999; 19: 286-94.
[7] Lam CSY, Edwards MH. Myopia: Prevalence and risk factors. Optician. 1999; 217: 28-31.
[8] Lin LLK, Tsai CB, Lieu JC, Shih YF, Hung PT. Correlation between ocular refractions with longitudinal study among schoolchildren in Taiwan. In: Myopia Updates: Proceedings of the 6th International Conference on Myopia. (Ed.) Tokoro T. Springer-Verlag, Tokyo. 1998; pp. 53-7.
[9] Lin LK, Shih YF, Tsai CB, Chen CJ, Lee LA, Hung PT, et al. Epidemiologic study of ocular refraction among school children in Taiwan in 1995. Optom Vis Sci. 1999; 76: 275-81.
[10] Tan NWH, Saw SM, Lam DSC, Cheng HM, Rajan U, Chew SJ. Temporal variations in myopia progression in Singaporean children within an academic year. Optom Vis Sci. 2000; 77: 465-72.
[11] Wong TY, Foster PJ, Hee J, Ng TP, Tielsch JM, Chew SJ, et al. Prevalence and risk factors for refractive errors in adult Chinese in Singapore. Invest Ophthalmol Vis Sci. 2000; 41: 2486-94.
[12] Wu HM, Seet B, Yap EPH, Saw SM, Lim TH, Chia KS. Does education explain ethnic differences in myopia prevalence? A population-based study of young adult males in Singapore. Optom Vis Sci. 2001; 78(4): 234-9.
[13] Matsumura H, Hirai H. Prevalence of myopia and refractive changes in students from 3 to 17 years of age. Surv Ophthalmol. 1999; 44 Suppl: 109-15.
[14] Katz J, Tielsch JM, Sommer A. Prevalence and risk factors for refractive errors in an adult inner city population. Invest Ophthalmol Vis Sci. 1997; 38: 334-40.
[15] Burton TC. The influence of refractive errors and lattice degeneration on the incidence of RD. Trans Am Ophthalmol Soc. 1990; (87): 143-55.
[16] Lewallen S, Lowdon R, Courtright P, Mehl GL. A population-based survey of the prevalence of refractive error in Malawi. Ophthalmic Epidemiol. 1995; 2:145-9.
[17] Yap M, Wu M, Liu ZM, Lee FL, Wang SH. Role of heredity in the genesis of myopia. Ophthalmic Physiol Opt. 1993; 13: 316-9.
[18] Teasdale TW, Fuchs J, Goldschmidt E. Degree of myopia in relation to intelligence and educational level. Lancet. 1988; 2: 1351-4.
[19] Yap M, Wu M, Wang SH. Environmental factors and refractive errors in Chinese school children. Clin Exp Optom. 1994; 77: 8-14.
[20] Angle J, Wissmann DA. The epidemiology of myopia. Am J Epidemiol. 1980; 111: 220-8.
[21] Lin LL, Chen CJ, Hung PT, Ko LS. Nation wide survey of myopia among school children in Taiwan. Acta Ophthalmol. 1988; 66: 29-33.
[22] Lin LK, Shih YF, Tsai CB, Chen CJ, Lee LA, Hung PT, et al. Epidemiologic study of ocular refraction among school children in Taiwan in 1995. Optom Vis Sci. 1999; 76: 275-81.
[23] Mutti DO, Zadnik K, Adams AJ. Myopia: The nature vs nurture debate goes on. Invest Ophthalmol Vis Sci. 1996; 37: 952-7.
[24] Saw SM, Katz J, Schein OD, Chew SJ, Chan TK. Epidemiology of myopia. Epidemiol Rev. 1996; 18: 175-87.
[25] Zhao JL, Pan XJ, Sui RF, Munoz S, Sperduto RD, Ellwein LB, et al. Refractive error study in children: Results from Shunyi district, China. Am J Ophthalmol. 2000; 129: 427-35.
[26] Simensen B, Thorud LO. Adult onset myopia and occupation. Acta Ophthalmol. 1994; 72: 469-71.
[27] Fan DSP, Lam DSC, Lam FR, Lau JTF, Chong KS, Cheung EYY, et al. Prevalence, incidence and progression of myopia in school children in Hong Kong. Invest Ophthalmol Vis Sci. 2004; 45: 1071-5.
[28] Dandona R, Dandona L, Srinivas M, Giridhar P, Prasad MN, Vilas K, McCarty CA, Rao GN. Moderate visual impairment in India: The Andhra Pradesh eye disease study. Br J Ophthalmol. 2002; 86: 373-7.