J Optom. 2011;**4(2)**:49-55

Journal of Optometry

www.elsevier.es/optometry

ORIGINAL ARTICLE

Refractive error among school children in Jhapa, Nepal

Gauri Shankar Shrestha[a,*], Digen Sujakhu[b], Purushottam Joshi[b]

[a]*B.P. Koirala Lions Centre for Ophthalmic Studies, Institute of Medicine, Tribhuvan University, Maharajgunj, Kathmandu, Nepal*
[b]*Mechi Eye Hospital, Birtamod, Jhapa, Nepal*

Received December 11, 2010; accepted January 2, 2011

KEY WORDS
Refractive errors;
Amblyopia;
Children

Abstract
Purpose: To evaluate the pattern of refractive errors among school children in Jhapa, Nepal.
Methods: A cross-sectional study was designed to evaluate refractive status of 2236 school children in three government schools and a private school. A complete eye examination was carried out in all children including slit lamp examination, fundus examination, retinoscopy and subjective refraction. Chi-square test was performed to analyze incidence of refractive error in gender; age groups; type of schools.
Results: Out of 2236 students, refractive error was present in 192 (8.58%). Unaided, presenting, and corrected visual acuity less than 6/12 (0.5) were present in 3.8%, 2.6% and 0.2%respectively. After refractive correction, visual acuity was significantly improved ($\chi^2 = 81.3$, df = 3, $p < 0.01$) to 6/6 in 98%students. Forty-five students (2.01%) were amblyopic. Refractive error was significantly prevalent ($\chi^2 = 3.707$, df = 1, $p = 0.05$, ODD = 1.3) in male (9.76%) than in female students (7.48%). refractive error was significantly high in private school than government schools ($\chi^2 = 6.7$, df = 1, $p < 0.01$) Myopia was the most common type (44.79%) of refractive error. The myopia of 2-6 diopters was most common in 48.8% Myopia was found to increase as age advanced. Hyperopia and astigmatism initially increased but later decreased with age.
Conclusions: Refractive error was a significant problem in schoolchildren in Jhapa. Myopia was the most common refractive problem. Private schoolchildren had significantly higher refractive errors.

*Corresponding author. B.P. Koirala Lions Center for Ophthalmic Studies, Institute of Medicine, Maharajgunj, Kathmandu, Nepal
E-mail: gs101lg@hotmail.com (G.S. Shrestha).

PALABRAS CLAVE
Errores refractivos;
Ambliopía;
Niños

Error refractivo en niños en edad escolar de Jhapa, Nepal

Resumen
Objetivo: Evaluar el patrón de errores refractivos entre niños en edad escolar de Jhapa, Nepal.
Métodos: Se diseñó un estudio transversal para evaluar el estado de 2.236 niños de tres escuelas públicas y una escuela privada. Se realizó una exploración completa de los ojos de todos los niños que incluyó examen con lámpara de hendidura, oftalmoscopia, retinoscopia y refracción subjetiva. Se realizó la prueba estadística de la χ^2 para analizar la incidencia de error refractivo por géneros, grupos de edad y tipos de escuelas.
Resultados: Se encontró error refractivo en 192 de 2.236 niños (8,58%). Se observó una agudeza visual espontánea, inicial y corregida inferior a 6/12 (0,5) en el 3,8%, 2,6%y 0,2%respectivamente. Tras la corrección refractiva, la agudeza visual mejoró significativamente ($\chi^2 = 81,30$, $df = 3$, $p = 0,00$) hasta 6/6 en el 98,0%niños. Se observaron 45 niños amblíopes (2,01%). El error refractivo fue significativamente más prevalente ($\chi^2 = 3,707$, $df = 1$, $p = 0,05$, ODD = 1,3) en los varones (9,76%) en comparación con las mujeres (7,48%). El error refractivo fue significativamente más alto en la escuela privada en relación con las escuelas públicas ($\chi^2 = 6,7$, $df = 1$, $p = 0,00$). La miopía fue el tipo de error refractivo más frecuente (44,79%). La miopía de 2-6 dioptrías fue la más frecuente en el 48,8% Se observó que la miopía aumentaba con la edad. Inicialmente la hipermetropía y el astigmatismo aumentaron, pero luego disminuyeron con la edad.
Conclusión: El error refractivo era un problema significativo en los niños en edad escolar en Jhapa. La miopía era el problema de refracción más frecuente. Los niños de escuelas privadas presentaron un número significativamente mayor de errores refractivos.

Introduction

An estimated 153 million people over 5 years of age are visually impaired as a result of uncorrected refractive errors, of which 8 million are blind. Approximately 12.8 million children in the age group 5-15 years are visually impaired from uncorrected or inadequately corrected refractive errors, estimating a global prevalence of 0.96%[1]

Poor vision and an inability to read material on the chalkboard due to refractive error can profoundly affect a child's participation and learning in the classroom.[2] It also has serious social implications for the child in school. According to the National Blindness Survey of Nepal of 1981, refractive error was identified as a primary ocular disorder in 1.3%of the 39,887 examined persons of all ages (Brilliant, 1988).[3] In the study done by the Refractive Error Study in Children (RESC) group, refractive error was the major cause of visual acuity of 0.5 (20/40) or worse in at least one eye in 89.5%of children in China and 56%in Nepal. The study further reported that reduced vision, because of myopia, was an important public health problem in school-age children; and more than 9%of children could benefit from prescription glasses.[4,5]

The purpose of this study was to gather information on the refractive status of students so that an effective approach can be planned to tackle the burden of readily correctable refraction problems in school children. Children were also provided with glasses and medicines when found necessary. When encountered with diseases that could not be managed at schools, they are brought to Mechi Eye Hospital for appropriate management.

Methods and methodology

Sample size and study design

A cross-sectional school-based study was conducted in 1150 students in three government schools of Jhapa: 429 students in Durga SS, 413 students in Amarjyoti SS, and 308 in Gyan Niketan SS; and 1086 students in a private school of Jhapa: Little Flower English HHS from June, 2009 to October 2009. Distribution of students is given in Table 1. All the children attending the schools visited were included in the study. Very few children, who were absent at the time of the school visit, were left out. There were around 18 private schools (available at http://enepal.asia/schoolout.htm#Jhapa. Accessed on December 26, 2010) and 376 government schools in Jhapa.[6] As the population was drawn from the schools which were easily accessible to the hospital, it was anticipated that prevalence of refractive error different than that found in earlier studies in Jhapa. Among these school children, 48.6%were male and 51.4% were female giving ratio of 0.94.

Jhapa is the esasternmost and one of the developed districts of Nepal, lies in fertile Terai plane of Mechi Zone, covers an area of 1,606 km^2 with Chandragadhi as its district headquarters, and has a total population of 217,608 children below 14 years of age. Male female ratio is 1.03. Jhapa borders Ilam district in the north, Morang district in the west, the Indian state of Bihar in the south and east, and the Indian state of West Bengal in the east. The district is divided into 47 Village Development Committees (VDCs) and three municipalities. Jhapa is the home to about

Table 1 Distribution of students in private (PS) and government schools (GS) by age and sex

Distribution by age and sex	PS, n (%)	GS 1, n (%)	GS 2, n (%)	GS 3, n (%)	Total, n (%)
5-7 years	174 (16)	88 (20.5)	122 (29.5)	77 (25)	461 (20.6)
8-10 years	280 (25.8)	165 (38.5)	121 (29.3)	84 (27.3)	650 (29.1)
11-13 years	356 (32.8)	104 (24.2)	103 (24.9)	78 (25.3)	641 (28.7)
14-16 years	276 (25.4)	72 (16.8)	67 (16.2)	69 (22.4)	484 (21.6)
Male	490 (45.1)	231 (53.8)	202 (48.9)	163 (52.9)	1,086 (48.6)
Female	596 (54.9)	198 (46.2)	211 (51.1)	145 (47.1)	1,150 (51.4)
Total	1,086 (100)	429 (100)	413 (100)	308 (100)	2,236 (100)

99 ethnic people. Majority includes Bahun (25.07%) and chhettri (14.9%) with minorities of Rajbanshi, Satar, Meche, Koche, Limbu, Dhimal, Gangain, Rai, Dhangad, Tamang, Uraon, Magar, Gurung, and Newar. Almost all the villages and towns are linked by roads. Jhapa has a literacy rate of 66.93% which is highest in Nepal after the capital city Kathmandu.[6]

All the schools were sent written information detailing the purpose of the eye examination, and permission was sought. All the parents were advised to be present on the day of examination. Those parents, who couldn't visit on the day of examination, were sent a letter stating their children's ocular health status. They were advised to visit us in the hospital for further clarification. The team carrying out the school screening consisted of an ophthalmologist, two optometrists, an ophthalmic assistant and a driver.

Tools and examination

The materials taken with the team were internally illuminated Snellen vision chart (model AME 20, appasamy), torch lights, hand held slit lamp (Heine Germany), direct ophthalmoscopes (Heine Beta 200, Germany), retinoscopes (Heine Beta 200, Germany), trial set, universal trial frames (Emami), RAF rule.

The students underwent the following examinations:

— Uncorrected, presenting and best corrected visual acuity was assessed in internally illuminated Snellen vision chart at 6meter distance to maintain the standard of visual acuity assessment.
— Extraocular movements and cover tests were performed using torch light, and convergence was tested using RAF rule.
— Anterior segment examination was carried out with the help of a torch light and portable slit lamp biomicroscopy (Heine, Germany).
— Retinoscopy and subjective refraction was performed in all the children. A cycloplegic refraction was performed with cyclopentotale HCL 1% in all the cases of hypermetropia, strabismus, and amblyopia, unstable end point of refraction, scissor reflex, anisometropia more than 1.00 D, high refractive error, and the cases where vision couldn't be improved with normal refraction, and suspected case of pseudomyopia. When family history of strabismus, amblyopia or high refractive error was present, cycloplegic refraction was also considered in those children. A cyclopentolate drop was instilled two times at an interval of 10 minutes, and refraction was carried out after 45 minutes from the first instillation. This process was followed by subjective refraction after 3 days.
— Fundus evaluation was done with a direct ophthalmoscope. Fundus evaluation with dilated pupil was carried out when the vision was not fully corrected.

Diagnostic criteria

The diagnostic criteria used for refractive error was 0.5 diopters or more for myopia, 1.00 diopter or more for hypermetropia and ≥ 0.75 DC for astigmatism. Presenting vision is defined by the visual acuity in the better eye unaided or using currently available refractive correction in spectacle wearers. Best-corrected vision was the visual acuity in the better eye achieved by subjects tested with refraction. A diagnosis of amblyopia was made if the vision was 6/9 or worse after a careful eye examination including funduscopy through dilated pupil and cycloplegic refraction.

Statistical analysis

All data were entered in the statistical package for social studies version 14.0 for evaluation. Chi-square test was performed to analyze differences in the refractive error between male and female, among different age group, and between government schools and the private school. P value for confidence interval of 95% was considered significant at the $p < 0.05$ level for prevalence estimates.

Result

Visual acuity in school children

A total of 2236 children between 5 and 16 years of age were examined in the four schools that were included in the study. Unaided visual acuity was normal (6/6) in 2044 (91.4%) students. Presenting VA was normal (6/6) in 2068 (92.5%) students. 110 students (5%) had presenting VA 6/9-6/18, 58 (3%) students had visual acuity 6/18-6/60 (Table 2). Out of 35 students (1.6%) who wore glasses, 24 students (1.1%) had presenting visual acuity 6/6. Unaided visual acuity worse than 6/12 (0.5) was present in 85 students (3.8%). After refractive correction, visual acuity

Table 2 Distribution of uncorrected, presenting, and best corrected visual acuity (VA)

VA	Unaided, n (%)	Presenting, n (%)	Wearing glasses, n (%)	Best corrected, n (%)
6/6	2,044 (91.4)	2,068 (92.5)	24 (1.1)	2,191 (98)
6/9-6/12	107 (4.8)	110 (4.9)	8 (0.4)	40 (1.8)
6/18-6/60	66 (3)	43 (1.9)	3 (0.1)	5 (0.2)
< 6/60	19 (0.8)	15 (0.7)	0	0

Table 3 Prevalence of refractive error by age and sex

Age in years	Total refractive error			Refractive error in PS			Refractive error in GS			p*
	No	Yes, n (%)	Odd (CI)	No	Yes, n (%)	Odd (CI)	No	Yes, n (%)	Odd (CI)	
5-7	431	30 (6.5)	0.7 (0.5-1)	159	15 (8.6)	0.8 (0.4-1.4)	272	15 (5.2)	1.0 (0.5-1.8)	0.15
8-10	596	54 (9.1)	1 (0.7-1.3)	251	29 (10.4)	1 (0.6-1.6)	345	25 (6.7)	0.9 (0.6-1.6)	0.09
11-13	582	59 (9.2)	1.1 (0.8-1.5)	319	37 (10.4)	1 (0.7-1.5)	263	22 (7.7)	1.2 (0.7-1.9)	0.24
14-16	435	49 (10.1)	1.3 (0.9-1.8)	245	31 (11.2)	1.1 (0.7-1.8)	190	18 (8.6)	1.3 (0.8-2.3)	0.35
	$\chi^2 = 4.4$, df = 3, p = 0.22	$\chi^2 = 0.8$, df = 3, p = 0.85	$\chi^2 = 2.54$, df = 3, p = 0.46							
Male	980	106 (9.8)	1.34 (1-1.8)	430	60 (12.2)	1.5 (1-2.2)	552	46 (7.7)	1.3 (0.8-2)	0.01
Female	1064	86 (7.5)		544	52 (8.7)		518	34 (6.2)		0.09
	$\chi^2 = 3.7$, df = 1, p = 0.05	$\chi^2 = 3.6$, df = 1, p = 0.06	$\chi^2 = 1$, df = 1, p = 0.3							
Total	2044	192 (8.6)		974	112 (10.3)		1070	80 (6.9)		

CI: 95%confidence interval; GS: government school; PS: private school.
p significant at 0.05 by chi-square test between sex and among age group.
*p significant at 0.05 by chi-square test between private and government school.

was significantly improved ($\chi^2 = 81.3$, df = 3, $p < 0.01$) to 6/6 in 98% students. Forty-five (2%) students were amblyopic. After refractive correction vision worse than 6/12 (0.5) was present in 0.2%

Prevalence of refractive error in school children

Prevalence of refractive error is shown in Table 3. A total of 192 students (8.6%) had refractive error. Refractive error was prevalent in 9.8%(106/1086) male and 7.5%(86/1150) female. Males had significantly higher refractive error ($\chi^2 = 3.707$, df = 1, p = 0.05, ODD = 1.3) than females. Prevalence of refractive error which was 6.5%(ODD-0.7) in age 5-7 years increased to 10.1%(ODD = 1.3) in age 14-16 years in the children suggesting that refractive error was prevalent more in elder children. But, statistically the increment was insignificant ($\chi^2 = 4.4$, df = 3, p = 0.22). Prevalence of refractive error in private school was 10.3% (112/1086). Like wise prevalence of three government schools were 7%(30/429), 6.9%(28/413), 7.1%(22/308) respectively.

The prevalence of refractive error was insignificantly different among these government schools ($\chi^2 = 0.03$, df = 2, p = 0.9). But, refractive error was significantly high in private school than government schools ($\chi^2 = 6.7$, df = 1, $p < 0.01$). Age distribution of refractive error was not significantly different between private and government schools. But male students of private schools had significant prevalence of refractive error (p = 0.01) than male students of government schools.

Magnitude and distribution of refractive error in school children

The magnitude of refractive error is given in Table 4. Myopia was the most common refractive error in 44.8%(86/192) followed by astigmatism (34.9%) and hypermetropia (20.3%). Myopia of 2.0-6.0 D was the most common type of refractive error in 48.8% Similarly astigmatism less than 1.0 D and hypermetropia less than 1.5 D were common in 61.2%and 66.7%students. Distribution of magnitude of myopia, hypermetropia and astigmatism was insignificantly different between male and female.

Overall, mean score for myopia, hypermetropia, and astigmatism was —2.8D ± 1.9 (Range, —0.5 to —9), +2D ± 1.3D (range, +1D to +6D), and —0.8DC ± 1.2 (range, +1.8 to —4D) respectively for confidence interval of 95% Emmetropia (Figure 1) was observed in 1762 (78.8%) whereas hypermetropia around + 0.5 D after cycloplegic refraction was observed in 282 students (12.6%).

At the age of 5-7 years (Figure 2), mean score for myopia was —0.9 ± 0.7 (range, —0.5 to —2.25). It was increased to —1.7 ± 1 (range, —0.5 to —4 D) at the age 8-10 years, —2.7 ± 1.7 (range, —0.5 to —6.5 D) at the age 11-13 years,

Table 4 Magnitude of refractive error

Type and magnitude of refractive error	Total, n (%)	Male, n (%)	Female, n (%)	p*
Myopia				
< 2 D	36 (41.9)	19 (37.3)	17 (48.6)	0.4
2-6 D	42 (48.8)	28 (54.9)	14 (40)	
> 6 D	8 (9.3)	4 (7.8)	4 (11.4)	
Total	86 (100)	51 (100)	35 (100)	
Hypermetropia				
≤ 1.5 D	26 (66.7)	15 (75)	11 (57.9)	0.3
> 1.5 D	13 (33.3)	5 (25)	8 (42.1)	
Total	39 (100)	20 (100)	19 (100)	
Astigmatism				
≤ 1 DC	41 (61.2)	22 (62.9)	19 (59.4)	0.8
> 1 DC	26 (38.8)	13 (37.1)	13 (40.6)	
Total	67 (100)	35 (100)	32 (100)	

*p significant at 0.05 by chi-square test in different types of refractive errors.

and —3.8 ± 2 (range, —1 to —9 D) at the age 14-16 years. At the age 5-7 years, mean score for hypermetropia was +1.8 ± 1 (range, +1 to +4 D). Mean score for hypermetropia was increased to 1.7 ± 1 (range, +1 to +4), +2.1 ± 1.6 (range, +1 to + 6) at the age 11-13 years and then decreased to +1.8 ± 1.3 (range, +1 to + 4 D). At the age 5-7 years, the mean score for astigmatism was —0.5 ± 0.9 (range, + 1 to —1.5 DC). Astigmatism was found increased to —0.7 ± 1 (range +1 to —2.5 D), —1 ± 1.4 (range, +1.5 to —4), and —0.9 ± 1.3 D (range, +1.75 to —2.5 D).

Other ocular abnormalities

During the time of screening, other abnormalities were also seen. They were convergence insufficiency in 1.8%, conjunctivitis in 1.3%, glaucoma suspect in 1.2%, squint in 0.9%, lens related (Pseudophakia, aphakia, congenital cataract) in 0.4%, chalazion in 0.2%, and nystagmus in 0.2%. These students were referred to Mechi Eye Care centre for further evaluation and management. Hence, a total ocular morbidity including refractive error was seen in 14.6%

Discussion

Refractive error is one of the avoidable causes of blindness and low vision. It can restrict progress in education, limit career opportunity and restrict access to information. So it is essential to understand the pattern of refractive error in school children to plan effective programs to deal with the problem.

The prevalence of refractive error among school children in this study was 8.6%(3.9%myopia, hypermetropia 1.7%, and 3%astigmatism). The prevalence of unaided, presenting and corrected visual acuity worse than 6/12 (0.5) was 3.8%, 2.6%, and 0.2%respectively in our study. Thirty-five children had spectacle during assessment of presenting visual acuity, 24 students had visual acuity 6/6 with spectacle. In the Pokhrel (2000) report, unaided, presenting, and best

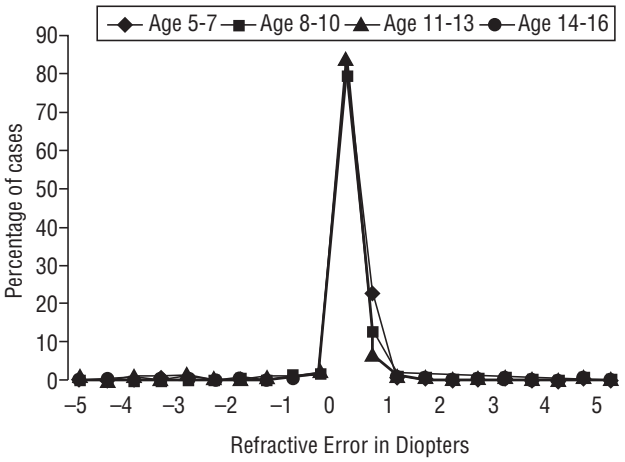

Figure 1 Distribution of refractive error in school children.

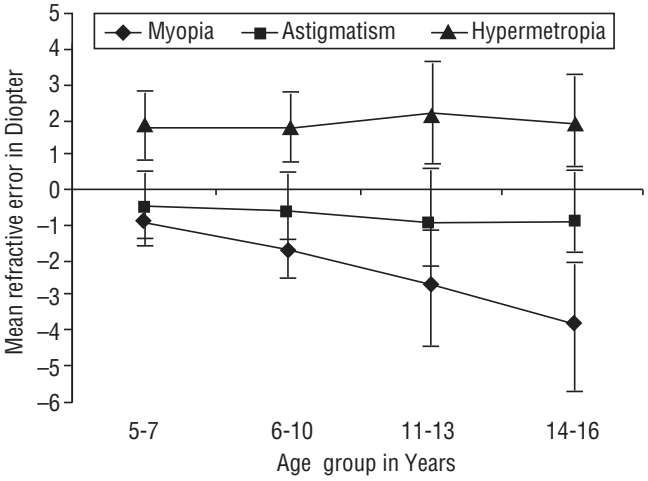

Figure 2 Age distribution of mean refractive error.

corrected visual acuity worse than 0.5 (6/12) at least in one eye was 2.9%, 2.8%, and 1.4%. In the same report, the prevalence of refractive error was reported 4.8%(hyperopia in 1.4%, myopia 1.2% and astigmatism 2.2%). The prevalence of refractive error was found higher in our study compared to Pokhrel (2000) report[5] although both studies were conducted in Jhapa district. Our study was conducted in school children while the Pokhrel report was population based. Cycloplegic refraction was not conducted in all cases in our study as compared to Pokhrel report. Description of prevalence of refractive error was also different in our study from Pokhrel report. In Pokhrel report, the prevalence of myopia was described as —0.5 diopter or less in either eye, hyperopia 2 diopters or greater in either eye, and astigmatism of 0.75 cylindrical diopter or greater. In contrast to that, we assigned myopia as 0.5 diopter or more in better eye, hypermetropia 1 or more in better eye, and astigmatism 0.75 or more in better eye. However, our finding was comparable to other school based reports, e.g. Nepal (2003)[7] found 8.1%in Kathmandu, Niroula (2009)[8] reported 6.43%in Pokhara, Kassa (2003)[9] reported 7.6%in Ethiopia, and Kalikivayi (1997) reported 7.4%in India.[10] But different prevalence rates were found in other population based

studies, e.g. Jialiang (2000)[4] in 12.8%in China, Trivedi (2006)[11] in 2.7%in Gujrat, and Pokhrel (2000) in 1.62%in Jhapa. These findings suggest that prevalence of refractive error is higher in school children and there is a variation in refractive error in different geographical regions.

The prevalence of vision impairment was present in 5 students (0.2%) had best corrected visual acuity worse than 6/12 for which obvious pathological condition couldn't be revealed. In Pokhrel (2000) report, the prevalence of uncorrectable cause of vision impairment was reported in 0.44%had best-corrected visual acuity 0.5 (6/12) or worse in the better eye. In Sapkota (2008),[12] the prevalence of vision impairment was reported in 0.86%had best corrected visual acuity less than 6/12 in both eyes.[12] Prevalence of visual impairment as reported high in both the Pokhrel (2000) and the Sapkota (2008) study. Both studies reported other causes of visual impairment like cataract, retinal disorder, and corneal opacity and unexplained, apart from refractive error. In our study, pseudophakia and aphakia were noted in 0.4% However, refraction in those cases could improve vision. But, our study was limited to only few schools and sample coverage was poor. Owing to this fact we would have missed some other important clinical conditions which could have been prevalent in other schools.

Prevalence of refractive error was found invariably increased with increasing age (Table 3). Statistically, the increment was insignificant ($\chi^2 = 4.4$, df = 3, $p = 0.22$). Male (9.8%) had significant ($\chi^2 = 3.7$, df = 1, $p = 0.05$, ODD = 1.3) prevalence of refractive error than female (7.5%). Myopia was the most common refractive error (44.8%) which was followed by astigmatism (34.9%) and hyperopia (20.3%). Myopia range 2-6 D was most common (Table 4) in 48.8% followed by myopia less than 2 D in 41.9% Astigmatism less than 1.5 D was common in 66.7% Number of myopic students was found increased from 7%at 5-7 years of age to 38.4%14-16 years of age. This finding was in an agreement with studies by Nepal (2003),[7] Pokhrel (2010),[13] Sapkota (2008) and Niroula (2009).[8] The ratio of number of myopic male students with myopic female students was 1.4 (Table 4). But, the ratio of number of hypermetropic (1) and astigmatic (1.1) males and females students was almost equal. This finding suggests that males were more at risk of developing myopia than females. Amblyopia was present in 2.01%children. If this number of amblyopia is considered out of 192 children having refractive error, it would be an intense problem (23.44%). Some sort of preschool screening Programme should be initiated to reduce its significance.

Refractive error in private school children was observed in 10.3%of the students (112/1086) and in government schools was seen in 6.9%(80/1150). It was significantly higher in private school children than government school children ($p < 0.01$). Comparable findings were reported by Niroula (2009)[8] in 9.24%private and in 4.29%government school students, by Pokhrel (2010)[12] in 11.8%urban and 8%rural school children, and by Ali (2007)[14] in 44 children in government school and in 63 children in private school. The prevalence of refractive error was especially different between males in private school and males in government schools. Private school students came from more privileged families compared to government school students. Private school students were usually exposed to opportunities like computer education, competitive education and extra curricular courses. These could be some of the possible reasons which have to be explored.

Ocular morbidity in our study (14.6%) was seen slightly higher than ocular morbidity in the Nepal (2003) report at 11%[7] The reason could be the lack of awareness and poorer accessibility to eye care system in Jhapa than Kathmandu. Mechi eye hospital is the only eye hospital that has been providing comprehensive eye care and screening services in the Jhapa district of Nepal since 1996. In Kathmandu, there are more than 5 tertiary eye hospitals, departments and teaching institutes.

Finding of the prevalence of refractive error is the major cause of visual disability in school children in Jhapa. The most encouraging fact about the visual disability is that it can readily be correctable in 97.4%(187/192) with spectacle correction. Though programme has to be focused on all type of refractive errors, more provision is required to reduce or eliminate visual impairment due to myopia in elder students. Though ethnic distribution of prevalence of refractive error is not studied and exclusive coverage of schools is not attended, there is no reason to suspect that students studying in other part of schools or area in Jhapa can experience refractive error different from students studied in enrolled schools. Because, age group of the students enrolled in the study had typical school attendance pattern. There is an apparent need for parental as well as school education programs along with effective strategies for providing school-based vision screening, quality optometric services, and provision of providing affordable spectacles.

Acknowledgements

We would like to heartily thank Mr. Ajit Thakur, Optometrist, and Mr. Kishor Rijal, Ophthalmic Assistant, for helping during eye examination and data collection. We would like to thank Mr. Mike Hollenback for helping us edit the article.

Conflict of interests

Authors declare that they don't have any conflict of interests.

References

1. Dandona R, Dandona L. Refractive error blindness. Bull World Health Organ. 2001;79:237-243.
2. Negrel AD, Maul E, Pokharel GP, Zhao J, Ellwein LB. Refractive error study in children: sampling and measurement methods for a multicountry survey. Am J Ophthalmol. 2000;129:421-426.
3. Shrestha SP, Bhat KS, Binu VS, Barthakur R, Natarajan M, Subba SH. Pattern of refractive errors among the Nepalese population: a retrospective study. Nep J Oph. 2010;2:87-96.
4. Jialiang Z, Xiangjun P, Ruifang S, Sergio RM, Robert DS, Leon BE. Refractive error study in children: results from Shunyi District, China. Am J Ophthalmol. 2000;129:427-435.
5. Pokharel GP, Negrel AD, Munoz SR, Ellwein LB. Refractive error study in children: results from Mechi Zone, Nepal. Am J Ophthalmol. 2000;129:436-444.

6. District profile, Jhapa. Government of Nepal, National Planning Commission Secretariate, Central Bureau of Statistics, Kathmandu. Available at: http://www.cbs.gov.np/district_profile_contents.php
7. Nepal BP, Koirala S, Adhikary S, Sharma AK. Ocular morbidity in schoolchildren in Kathmandu. Br J Ophthalmol. 2003;87: 531-534.
8. Niroula DR, Saha CG. Study on the refractive errors of school going children of Pokhara city in Nepal. Kathmandu University Medical Journal. 2009;7:67-72.
9. Kassa T, Alene GD. Prevalence of refractive errors in pre-school and school children of Debark and Kola Diba towns, North-western Ethiopia. Ethiop J Health Dev. 2003;17:2:117-124.
10. Kalikivayi V, Naduvilath TJ, Bansal AK, Dandona L. Visual impairment in school children in Southern India. Indian J Ophth. 1997;45:129-134.
11. Trivedi V, Zalavadia S, Bhatta J, Pawar T, Kupmavat B. Prevalence of Refractive Errors in Children (Age Group 7-15 Years) of Rural and Urban Area of Gujarat: A Population Based Study. Indian Journal of Applied Basic Medical scieces Ahmedabad. 2006. Available at: http://openmed.nic.in/1933/01/bhatt1.pdf
12. Sapkota YD, Adhikari BN, Pokharel GP, Poudyal BK, Ellwein LB. The prevalence of visual impairment in school children of upper-middle socioeconomic status in Kathamndu. Ophthalmic Epidemiol. 2008;15:17-23.
13. Pokharel A, Pokharel PK, Das H, Adhikari S. The patterns of refractive errors among the school children of rural and urban settings in Nepal. Nep J Oph. 2010;2:114-120.
14. Ali A, Ahamad I, Ayub S. Prevalence of undetected refractive errors among school children. Biomedica. 2007;23:96-101.