

Refractive Errors and Visual Anomalies in Schoolchildren in the Kavrepalanchowk District

Marasini S¹, Sharma R², Sthapit PR³, Sharma D⁴, Koju U⁵, Thapa G⁶, Nepal BP⁷

¹⁻⁷Department of Ophthalmology
Dhulikhel Hospital,
Kathmandu University Hospital
Dhulikhel, Nepal

Corresponding author

Sanjay Marasini, B. Optom

Department of Ophthalmology

Dhulikhel Hospital - Kathmandu University
Hospital

Dhulikhel, Nepal

Email. thesanzay@gmail.com

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ABSTRACT

Background

Schoolchildren form an important target group for a nation, as any ocular morbidity in this age group has huge physical, psychological and socio-economical implications. Childhood eye disorders can contribute to the burden of blindness in any society. This study aims to highlight the prevalence of ocular morbidity in governmental schools in a sub-urbanised area of Nepal, in relation to ethnic variation.

Methods

A descriptive study, and the study population used were schoolchildren who were examined in their schools and afterwards referred to the hospital if required. Presenting and best corrected visual acuity, refraction, binocularity assessment, anterior and posterior segment evaluation was carried out. Data was analysed statistically using SPSS software, version 14.

Results

We examined 1,802 school children. The mean age was 10.78±3.61 years. Ocular abnormality was detected in 11.7%. Low vision and blindness was rare (0.11% and 0.05%). Ocular morbidities were more common in Newar communities (3.71%) followed by Brahmanas (3.38%). Lid abnormalities were the most common (3.55%), and morbidities in each ethnicity were followed by refractive errors (3%), conjunctival abnormalities (1.10%), strabismus (0.88%) and amblyopia (0.33%). Refractive errors were most common among Newar communities (1.16%) at almost twice as many Brahmanas (0.61%) followed by Mongolians (0.49%). Convergence insufficiency was detected in 2.49% (p<0.01).

Conclusions

Ocular morbidities are common in children in Kavrepalanchowk District with lid abnormalities being the most common issue, probably due to a lack of hygienic practice. Ethnic variation of ocular morbidities is an important observation mostly for refractive error and strabismus.

Key Words

blepharitis, blindness, ethnicity, oculo-visual, visual acuity

INTRODUCTION

School screenings for eye diseases is aimed to identify children who are at risk of eye diseases at a sub-clinical stage and which can be diagnosed with the application of tests, examinations and procedures carried out rapidly on a large scale. Although Vision 2020: the right to sight imposes a mandate to abolish the preventable causes of blindness, fewer infrastructures and resources are available.¹

School children form an important target group for the nation as any ocular morbidity in this age group has huge physical, psychological and socio-economical implications. Early diagnosis of the ocular morbidity and appropriate correction helps in overall visual development and better academic performances as well. In a study conducted in school children in Kathmandu; an urbanized area; the prevalence of ocular morbidity was observed in 11%.² Another study claims that refractive errors are more prevalent in school children of private schools over students at government schools.³

Population-based refractive error surveys in children were conducted in China, Nepal, and Chile with the same investigative protocols. The aim was to elucidate the differences in the prevalence of refractive errors across different geographic distribution and ethnic origins, as well as cultural settings in order to get directly comparable data from different countries. These studies suggested that the prevalence of myopia is much higher in the Chinese and the Caucasian population of Chile, in comparison to the Nepalese population. It also suggested that Caucasian populations are more likely to be hyperopic than Asian populations.^{4,5,6} One study has explored the distribution of refractive errors in different ethnic groups of Nepal. They concluded that refractive errors are more prevalent in Newars and Aryans.⁷

The aim of the study is to explore and document the prevalence of ocular morbidity in government school children of the Kavrepalanchowk District. Findings of the present study are expected to highlight the ethnic variation in the prevalence of ocular morbidity.

METHODS

This is a descriptive study conducted in government schools. The children belonged to different socioeconomic strata and ethnic groups. Eight schools were selected randomly in Dhulikhel and nearby villages. Permission was sought from the headteachers of the school after which a date to conduct the screening was agreed upon. Information was distributed among students about the day of screening so as to involve the maximum number

of students. All the children attending school during the screening were included in the study. Very few of them were unwilling to participate and absences in the class were excluded from the study. A team from Dhulikhel Hospital - Kathmandu University Hospital (DH-KUH) which included an ophthalmologist, an optometrist, an ophthalmic assistant and two medical interns ran the programme. The screening programme started in 2007. This paper consists of the analysis of data from the schools screened between April 2007 to August 2010.

Presenting distance visual acuity was tested by Snellen's chart at a distance of 20 feet, followed by pinhole in case of reduced visual acuity. Children whose visual acuity could not be recorded were examined with torch light in a semi dark room and noted whether their eyes would follow light. In addition retinoscopies were carried out on all of the school children to rule out any refractive errors. All other students with a visual acuity of $\leq 20/30$ were referred to DH-KUH with a referral note where cycloplegic refraction was carried out. All the students with referral notes presented to the hospital.

Cover test, convergence test, extra ocular motility examination was performed on every child. Any child found to have strabismus; poor fixation and any other abnormality was referred to the hospital for further evaluation and management. Ophthalmolcopy was done in all.

The standards for quantifying refractive error that we used were as follows: myopia was considered to be a mean spherical equivalent refractive error of ≥ 0.50 DS; hyperopia was defined as $\geq +1.00$ D; astigmatism was defined as ≥ 1.00 DC; and anisometropia (mean sphere) was defined as a difference of ≥ 1.00 Diopters. Data analysis was conducted with Statistical Package for the Social Sciences (SPSS) version 14.

RESULTS

A total number of 1,802 children participated in the study among which 959 (53.2%) were female and 843 (46.8%) male. The mean age was 10.78 ± 3.61 years (range: 3 years to 22 years). Of the total, 173 (9.6%) were pre-primary and 771 (42.8%) were primary level students. The number of children under five years old was 173 (4.5%). Ocular abnormality was detected in 210 (11.7%) of which 91 (43.33%) were male and 119 female (56.66%), statistically not significant (χ^2 test = 1.135, df = 1, p = 0.287).

Best corrected normal to subnormal visual acuity (20/20 to 20/60) in the better eye was observed in 1,741 (96.61%) children. Two children (0.11%) had low vision

(>20/60 to 20/400) and one (0.05%) child remained blind (>20/400) even after treatment. The distribution of presenting and best corrected visual acuity is presented in Table 1.

Table 1. Number and percentage of PVA and BCVA.

Visual acuity	(No. and %)	
	PVA	BCVA
20/20	1646 (91.3)	1738(96.44)
>20/40	78 (4.3)	3(0.16)
>20/200	16 (0.9)	2(0.11)
>20/400	2 (0.1)	0(0.00)
<20/400	2 (0.1)	1(0.05)
Believed sighted (uncooperative)	58 (3.2)	58(3.21)
Total	1802 (100)	1802(100)

PVA, presenting visual acuity; BCVA, best corrected visual acuity; believed sighted, children on whom appropriate visual acuity could not be tested because of their uncooperative nature.

Ocular morbidities were most common in Newars (3.71%) followed by Brahamans (3.38%) and Chhetris (2.05%). Lid abnormalities were the most common (3.55%) morbidities in each ethnicity followed by refractive errors (3%), conjunctival abnormalities (1.10%), strabismus (0.88%) and amblyopia (6 cases, 0.33%). The distribution of different types of ocular morbidity with ethnicity is presented in Table 2.

Table 2. Number and percentage of ocular morbidity pattern in different ethnic groups

Type of ocular morbidity	No. (%)					Total (%)
	Brahamans	Newars	Mangoloids	Chhetri	Others	
Refractive error	11(0.61)	21(1.16)	9(0.49)	8(0.44)	4(0.22)	53 (2.94)
Myopia	7(0.38)	18(0.99)	6 (0.33)	5 (0.27)	3 (0.16)	39 (2.16)
Hyperopia	3(0.16)	3(0.16)	3(0.16)	2 (0.11)	1(0.05)	12 (0.66)
Astigmatism	1(0.05)	7(0.38)	1(0.05)	5(0.27)	1(0.05)	15 (0.83)
Convergence insufficiency	13 (0.72)	17(0.94)	7(0.38)	8(0.44)	0 (0.00)	45 (2.49)
Strabismus	9(0.49)	3(0.16)	1(0.05)	3(0.16)	0(0.00)	16 (0.88)
Lid disorders	17(0.94)	20(1.10)	10(0.55)	12(0.66)	5(0.27)	64 (3.55)
Conjunctival disorders	7(0.38)	2(0.11)	4(0.22)	5(0.27)	2(0.11)	20(1.10)
Corneal disorders	2(0.11)	0(0.00)	1(0.05)	0(0.00)	0(0.00)	3 (0.16)
Episcleritis	1(0.05)	3(0.16)	1(0.05)	1(0.05)	1(0.05)	7(0.38)
Optic atrophy	1(0.05)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	1(0.05)
Chemical injury	0(0.00)	1(0.05)	0(0.00)	0(0.00)	0(0.00)	1(0.05)
Total (%)	61(3.38)	67(3.71)	33(1.83)	37(2.05)	12(0.66)	210(11.7)

DISCUSSION

Only 98 (5.4%) children had presenting visual acuity of less than 20/20 and 58 (3.21%) children could not be tested with Snellen's chart. Six (0.33%) children could not be corrected to 20/30 or better because of amblyopia. Low

vision (0.11%) and blindness (0.05%) was rare. Ocular abnormalities were more common in Brahamans than Newar communities and other ethnicities.

The overall prevalence of ocular morbidity observed in the study is similar to that of Nepal. (11%).² The study found that the major ocular disorders were refractive error, strabismus, traumatic eye injuries, vitamin A deficiency and other congenital anomalies in a study sample of 1,100 school children. We observed the major ocular disorders to be external eye infections, refractive error and strabismus, conjunctival and corneal disorders. We did not find any cases with vitamin A deficiency or congenital anomalies.

In Nepal, vitamin A capsule supplementation as well as educational programmes have been effective for the last 12 years, as a government initiative in collaboration with various organisations, and as a result, vitamin A consumption has increased significantly.⁸ The reason behind our observation with no cases related to vitamin A deficiency can be accounted for a positive outcome of this national effort. Ocular morbidity that was observed in this study is lower than that of Nigeria (15.5%).⁹ This difference might be because of the varying urbanised population and ethnic differences. In Ethiopia the prevalence of ocular morbidity in children was very high (55% to 63%); followed by trachoma which was also the leading cause for it (34% to 54%); followed by other common disorders

such as refractive error (6.3% to 12%); strabismus (0.8% to 4.4%); corneal opacity (1.3% to 1.8%); conjunctivitis (2.3% to 15.3%); and xerophthalmia (1.1% to 1.7%). This might be because of the low socio-economic level and

underdeveloped health infrastructure.^{10,11}

Lid abnormalities in our study were the most common. Our findings (3.55%) do not compare well with Nigerian (0.6%)⁹ and Durban, South African (2.7%) studies.¹² We assume that poor hygienic practice in the rural areas in Kavhrepalanchowk District is attributable to the higher frequency of lid abnormalities, blepharitis being the most common disorder, followed by meibomitis. Conjunctival, corneal and retinal disorders were low.

Convergence insufficiency was a common disorder with higher prevalence in secondary level students (1.77%) than in primary level students (0.721%). This may be attributable to the increased reading hours of students at secondary school. It is justifiable because none of the pre-primary students had CI. CI was more common in the female population of the study ($P > 0.005$). Hormonal changes might have had some role to play in this observation because most of the girls (499, 52%) were in their menarche age (11 -13 years).

We detected a corneal ulcer in one child (0.05%) who was attending school without treatment. Corneal opacity following trauma were observed in 0.11%, a comparable rate as that of 0.12% of Mechi zone study. A higher rate (0.3%) is observed in Nigeria. Perhaps, different feeding nature of children contributes to this difference in observation.

Conjunctivitis was seen in 0.65%; much less than that in India (4.6%)¹³ and Nigeria (7.4%- 16%).^{9,14} This discrepancy might be because of the difference in study seasons or the very short duration of the study disease.

Aryans were found to have more prevalence of strabismus in comparison to other ethnicities with alternated diverging strabismus being common; an observation similarly noted by Nepaletal.² It was more common in females. Different genetic make-up, racial factors and environmental influences are considered for this variation. Prevalence of strabismus was higher (0.88%) in our study than that reported in Nigeria (0.3%) and lower than that of Mechi zone (2.1%), Kathmandu (1.63%) and Durban (1.3%)¹² but it was comparable to that of India (0.5%).¹³ Refractive errors and strabismus are believed to have a relatively lower incidence in black skinned races with hereditary factors being blamed for this peculiar epidemiology.¹⁴

The 1981 blindness survey of Nepal identified refractive error based on pinhole correction as a primary ocular disorder in 1.3% of the 39,887 population. Our figures are higher (3%). It might be because our study population was school children who are exposed to near work most of the time whereas blindness survey was conducted in all-age population. Moreover the blindness survey was conducted

more than 20 years ago and there might be the increasing trend in prevalence of refractive error because of the increased literacy rate and urbanisation of the country. The effect of urbanisation in refractive error has been reported in studies conducted in India. They have shown that the prevalence of myopia and hyperopia in urban India (7.1% and 7.7%) was higher than in rural India (4.1% and 0.8%).^{15,16} We observe the similar trend in refractive error prevalence in Kathmandu (8.1%); an urbanized area and our study (3%); in a rural location.

The Mechi zone study concluded that there is very little (1.3%) prevalence of refractive error in children in Nepal, but the prevalence was observed to be much higher in Kathmandu (8.1%) and Pokhara (6.43%) and the present study (3%). This discrepancy might be explained in terms of the study population because the former was a population based study and the latter was school-based study. Refractive error prevalence seen in our study is lower than that of Ajaiyeoba Aletal. (5.8%) in Nigeria, and higher than that of Naidoo KSetal. (1.82%) in South Africa and Kehinde AVetal. (1.7%) in Nigeria. These differences probably reflect the unique hereditary influences among various groups and the different environmental factors. Refractive error is more prevalent in Newar community; a study similarly noted by Karki KJD et al.⁷ There is an agreement that the prevalence of astigmatism lies more in Newars. They emphasize that there are indeed ethnic variations particularly marked for refractive errors. Our study supports this observation. Other studies support that there are significant differences in the refractive error prevalence as a function of ethnicity, even after controlling for age and sex.^{17,18}

The prevalence of refractive error in pre-primary, primary and secondary school children was 0.33%, 0.94% and 1.66% respectively. There was an age-related shift in refractive error from hyperopia in younger children (0.16% in 7 year olds) towards myopia in older (0.22% in 14 year olds). Similarly astigmatism is also seen to be more prevalent in the age above 12 years accounting for 0.61%. Higher prevalence of external eye infections may lead to the use of finger storubeyes, leading to topographical variation in the cornea and leading to astigmatism. Refractive error as a function of age is similarly observed by Khalaj M et al. In Iran¹⁹ and in other studies in China and Hong Kong. In various Chinese studies, 37% of children aged 6-12 years, and 50% of children aged 13-17 years suffered from myopia. Similarly, in Hong Kong 9% of children aged 7-8 years and 18.20% aged 11-12 years had myopia.^{20,21}

CONCLUSION

Ocular morbidities are common in children in the

Kavhrepalanchowk District with external eye infections being the most common problem, probably due to a lack of good hygienic practice. School awareness programmes about personal hygiene may also help to reduce external eye infections. Vitamin A related ocular morbidity was not observed in this study. The ethnic variation of ocular morbidity is an important observation mostly for refractive errors and strabismus.

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REFERENCES

1. Holden BA, Resnikoff S. The role of optometry in Vision 2020. *J Community Eye Health* 2002;15:33–6.
2. Nepal BP, Koirala S, Adhikary S, Sharma AK. Ocular morbidity in school children in Kathmandu. *Br J Ophthalmol* 2003;87:531–34.
3. Niroula DR, Saha CG. Study on the refractive errors of school going children of Pokhara city in Nepal. *Kathmandu Univ Med J* 2009;7:67–72.
4. Zhao J, Pan X, Sui R, Sperduto RD, Ellwein LB. Refractive error study in children: results from Shunji District, China. *Am J Ophthalmol*. 2000;129:427–35.
5. Maul E, Barroso S, Munoz SR, et al. Refractive error study in children: results from La Florida, Chile. *Am J Ophthalmol* 2000;129:445–54.
6. Pokharel GP, Negrel AD, Munoz SR, Ellwein LB. Refractive Error Study in Children: results from Mechi Zone, Nepal. *Am J Ophthalmol* 2000;129:436–44.
7. Karki KJD, Karki M. Refractive error profile – a clinical study. *Kathmandu Univ Med J* 2003;2:208–12.
8. Population division, Ministry of health and population, government of Nepal. *Demographic and Health Survey, Nepal; 2007*. p.183.
9. Ajaiyeoba AI, Isawumi MA, Adeoye AO, Oluleye TS. Prevalence and Causes of Eye Diseases among Students in South-Western Nigeria. *Annals of African Medicine* 2006;5:197–03.
10. Yoseph W, Samson B. Screening of ocular abnormalities and subnormal vision in school children of Butajira town, southern Ethiopia. *Ethiop J Health Dev* 2001;15:125–30.
11. Shaffi M, Bejiga A. Common eye diseases in children of rural community in Goro district, Central Ethiopia. *Ethiop J Health Dev* 2005;19:148–52.
12. Naidoo KS, Raghunandan A, Mashige KP, Govender P, Holden BA, Pokharel GP, Ellwein LB. Refractive Error and Visual Impairment in African Children in South Africa. *Investigative Ophthalmology & Visual Science* 2003;44:3764–70.
13. Kumar R, Dabas P, Mehra M, Ingle GK, Saha and R, Kamlesh. Ocular morbidity amongst primary school children in Delhi. *Health and Population-Perspectives and Issues* 2007;30:222–29.
14. Kehinde AV, Ogwurike SC, Eruchalu UV, Pam V, Samaila E. School eye health screening in Kaduna-Northern Nigeria. *Nigerian Journal of Surgical Research* 2005;7:191–94.
15. Murthy GV, Gupta SK, Ellwein LB, Muñoz SR, Pokharel GP, Sanga L, Bachani D. Refractive error in children in an urban population in New Delhi. *Invest Ophthalmol Vis Sci* 2002;43:623–31.
16. Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Muñoz SR, Pokharel GP, Ellwein LB. Refractive error in children in a rural population in India. *Invest Ophthalmol Vis Sci* 2002;43:615–22.
17. Limburg H, Vaidyanathan K, Dalal HP. Cost effective screening of school children for refractive errors. *World Health Forum* 1995;16:173–78.
18. Kalikivayi V, Naduvilath TJ, Bansal Ak, Dandona L. Visual impairment in school children in southern India. *Indian J Ophthalmol* 1997;45:129–34.
19. Khalaj M, Gasemi M, Zeidi IM. Prevalence of Refractive Errors in Primary School Children [7-15 Years] of Qazvin City. *Eur J Sci Res* 2009;28:174–85.
20. Cung KM, Mohidin N, Yeow PT, Tan LL, O'Leary D. Prevalence of visual disorders in Chinese school children. *Optom Vis Sci* 1996;73:695–700.
21. Edward MH. The development of myopia in Hong Kong children between the ages of 7 and 12 years: a five-year longitudinal study. *Ophthalmic Physio Opt* 1999;19:286–94.