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Research Article

Refractive Error Among Public and Private School Children in Dhangadhi City of Far West Nepal

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Abstract

Objective: The objective of this study is to compare the prevalence of refractive error among private and public-school children.

Methods: Altogether 18 schools of Dhangadhi (capital city of Far West Province of Nepal) with a mix of public and private schools were randomly selected. We collected data from children studying in grade 1-10 from January to March 2018. Eye examination was performed for all children satisfying inclusion criteria. Refractive error was determined by retinoscopy followed by subjective refraction.

Results: A total of 5128 school children (3159 from public and 1969 from private) were examined. The overall prevalence of refractive error was 80 (2.5%) (95% CI 2%-3.1%) children in public schools, of which 48 (1.5%) (95% CI 1.1-2) had myopia and 32(1%) (95% CI 0.7-1.4) had hyperopia. Among private school children, refractive error was present in 93 (4.7%) (95% CI 3.8-5.7) children, of which 55

(2.8%) (95% CI 2.1-3.6) had myopia and 3 (1.9%) (95% CI 1.4-2.7) had hypermetropia. Among Brahmin/Chhetry ethnic group, refractive error was 40 (3.5%) in public school and 75 (5.2%) in private school children.

Conclusion: The prevalence of refractive error among private school children is twice as that in public school children which was higher in Brahmin/Chhetry than other ethnic groups.

Keywords: Refractive Error; Prevalence; School; Ethnicity; Reading; Outdoor Activity; Far West Nepal

1. Introduction

Refractive error (RE) is one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness [1]. A series of population-based surveys in children commonly known as RESC studies found that refractive error as the cause of visual impairment (<6/12 in the better eye) in children. They found visual impairment of 55.1% in Nepal, 70% in rural India, 83% in urban India, 93% in rural China, 55% in Chile and 71% in South Africa [2-8].

In a large, multicenter research survey, namely the COMET (Correction of Myopia Evaluation Trial) study it was found that the parental education and occupation were associated with myopia in parents [8]. Several investigators have suggested environment to be a major factor for the increasing prevalence of myopia in Asia over the last few decades, with small contribution from genetic factors [9]. Despite sharing common ancestry in the north of Nepal, lifestyle difference has been pointed out as the possible reason for lower prevalence of myopia (2.9%) among Sherpa children in rural Solu-Khumbu in comparison to Tibetan children in urban Kathmandu (21.7%) [11].

The prevalence of refractive error among school children in Nepal is found to be higher among private schools (19.74% and 10.3%) in comparison to public school children (5.6% and 7%) [12-14].

Dhangadhi is a growing city in Far West Nepal with a heterogeneous population of 147741 [15]. In recent years, Dhangadhi is undergoing rapid urbanization with more people engaged in commercial activities and almost all children going to school. Results from other studies show that education has influence on myopia. There are two types of schools in Dhangadhi in terms of ownership i.e., public, and private. Public schools receive government funding, and the schooling is not strict whereas private schools run with funding from parents so have strict schooling with lot of educational pressure.

Though studies have found that refractive error prevalence is higher among private school in comparison to public school children, few studies have compared refractive error prevalence in public and private school children [14,16,17]. The higher prevalence of refractive error among children going to private school in comparison to those going to public schools could be related to rigorous schooling in private schools. Private school's children do more intensive work for longer hours and, they start school earlier than public school children. Private school

children go to school 3 years earlier than public school children.

The aim of this study was to compare refractive error prevalence among private and public-school children. The educational pressure could be responsible for refractive error prevalence among public and private school children to vary. So, the findings from this study are expected to be useful for planning and conducting school screening program in the province.

2. Material and Methods

2.1 Sample population

This is a school based cross sectional study. We collected data from children studying in grade 1-10 in public and private schools of Dhangadhi sub metropolitan city. Assuming prevalence of refractive error among children be 8.6%, taking with probable error (E) = 10% of p, Z = standard normal variate = 1.96, and 10% nonresponse rate, the sample size for the study will be 4492($n= Z^2 (p)(1-p) /*E^2$). According to the education department, there were 74 Government schools (21681 students) and 55 boarding schools (15830 students). Now according to the students' parentage, at least 2596 students from public schools and 1896 students from private schools were needed for this study.Using simple random sampling, 10 government schools and eight boarding schools were selected.

Schools with less than 200 students were excluded, and all children from selected schools aged 6 years and above, willing to take part in the study and have parental consent were included. Eye examination was performed for all children including those not included in the study. Data were collected during January to March 2018. After obtaining permission to conduct the study from education and health departments, selected schools were informed about the study and school screening date by ophthalmic team. School teachers took parental consent and asked each student to fill in the questionnaire presented in Nepali. The team also explained study details to the children. Glasses were distributed at no cost to those who required. Any pathology found was referred to Pediatric Eye Department at Geta eye Hospital, Kailali, Nepal. Ethical permission to conduct study on human subjects was taken from ethical review committee of Tilganga Institute of Ophthalmology (TIO). Data was collected with the help of clinical tests and questionnaire.

2.2 Examination

The main outcome variable was refractive error. Predictor variables were age, gender, ethnicity, and outdoor activities. Data were recorded in specially developed forms. Visual acuity was measured by an ophthalmic assistant experienced in pediatric care using Snellen's chart at 6 meters distance. The line which the child read correctly was recorded as visual acuity score for that eye. In addition, the ophthalmic assistant examined each child with torch light and portable slit lamp for ocular signs of eye disease. The ophthalmic assistant also asked each child for any problem related to eye. Those with reduced visual acuity ($\leq$ 6/9), with obvious ocular signs or symptoms were referred to optometrist experienced in pediatric care for comprehensive eye examination. The optometrist examined each child for any signs of eye disease with portable slit lamp and ophthalmoscope.

Retinoscopy was performed with a streak retinoscope in a semi dark room at working distance of 50 centimeters followed by subjective refraction. Cycloplegic refraction was performed in children with squint, amblyopia, significant hyperopia, or children in whom refractive status could not be determined accurately. Cycloplegia was attained by installation of 2 drops of cyclopentolate hydrochloride 1%, at 5 minutes interval. If light reflex was present after 20 minutes third drop was installed. Light reflex and dilatation were checked after additional 15 minutes. Cycloplegia was considered complete if pupil dilated to 6 mm or greater and light reflex absent [18]. Cycloplegic refraction was not performed in cases known to be contraindicated for cycloplegia, i.e., narrow anterior chamber angle, history of allergy to eye drops, history of seizures, systemic diseases like asthma and cardiovascular diseases and reports fear of getting drops in eyes. Myopia was defined as -0.5D or more, hyperopia 2D or more spherical equivalent and astigmatism as 0.75 D difference in refractive error between the two principal meridians. Anisometropia was defined as a difference of 1 diopter or more in spherical or cylindrical power between both eyes.

2.3 Statistical analysis

The collected data were entered, cleaned, and coded in Microsoft Excel. Results were presented in the form of means and proportion with 95% confidence interval. Statistical Analysis was performed using Epi Info 2007 and SPSS. For continuous data, independent test was used for the difference. For association of categorical data, Chi square test was used. Also, odds ratio was calculated to quantify the result. P value <0.05 was considered as statistically significant.

3. Results

A total of 5128students were examined of which 3159 were from public schools and 1969 were from private schools. Out of total students, 2521 (49.2%) were females and 2607 (50.8%) were males. In public schools 1740 (55.1%) were females and 1419 (44.9%) were males whereas in private schools 781(39.7%) were females and 1188 (60.3%) were males. There was statistical significance difference ($p \leq 0.01$) in gender in comparing both school types. In public schools, mean age of females was 12.9 years (SD ± 3.0) and for males it was 13.2 years (SD ± 2.9) whereas in private schools mean age of females was 11.1 years (SD ± 2.8) and for males 11.2 years (SD ± 2.9), there was statistical significance in age in public schools and private schools ($p \leq 0.001$).

There were 80(2.5%) children with refractive error in public schools of which 48(1.5%) (95% CI 1.1-2) had myopia and 32(1%) (95% CI 0.7-1.4) had hyperopia whereas 93 (4.7%) children had refractive error in private schools of which 55(2.8%) (95% CI 2.1-3.6) had myopia and 38(1.9%) (95% CI 1.4-2.7) had Hyperopia.

Refractive Error	Total		Public		Private	
	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)
Myopia	103	2 (1.6-2.4)	48	1.5 (1.1-2)	55	2.8 (2.1-3.6)
Hypermetropia	70	1.4 (1-1.7)	32	1 (0.7-1.4)	38	1.9 (1.4-2.7)
Normal	4955	96.6 (96.1-97.1)	3079	97.5 (96.8-98)	1876	95.3 (94.2-96.2)
Total	5128	-	3159	-	1969	-

Table 1: Prevalence of Refractive Error.

Out of total refractive errors about 60% myopia and 40% hyperopia was found among both school types. The proportion of female with refractive error was 60% (n=48) in public schools and 37.6% (n=35) in private schools. Among public school children, astigmatism was present in 13.8% (n=11) right eyes and 11.3% (n=9) left eyes whereas among private school children, astigmatism was present in 18.3% (n=17) right eyes and 19.4% (n=18) left eyes.

Among total refractive error age group 11-15 years were 92 (53.2%) and among total normal, 2631 (53.1%) were normal. Among age group 5-10 years, 45 (26%) children had refractive error and 1445 (29.2%) were normal with no statistically significant difference among both groups p-0.53 OR 1.1 (95% CI 0.8-1.6). Among age group 16-20 years, 36 (20.8%) children had refractive error and within same group 879 (17.7%) children were normal, which was also statistically not significant p-0.229 OR 1.3 (95% CI 0.8-2.1).

Age code	Total			Public			Private		
	Total	RE, N	% (95% CI)	Total	RE, N	% (95% CI)	Total	RE, N	% (95% CI)
5-10	1490	45	3 (2.2-3.9)	627	12	1.9 (0.8-3)	863	33	3.8 (2.5-5.1)
11-15	2723	92	3.4 (2.7-4.1)	1785	44	2.5 (1.7-3.2)	938	48	5.1 (3.7-6.5)
16-20	915	36	3.9 (2.7-5.2)	747	24	3.2 (1.9-4.5)	168	12	7.1 (3.2-11)
Total	5128	173	3.4 (2.9-3.9)	3159	80	2.5 (2-3.1)	1969	93	4.7 (3.8-5.7)

Table 2: Prevalence of Refractive Error among different age groups.

Among caste/ethnic groups 3.5% (n=40) refractive error in public schools and 5.2% (n=75) in private schools was among Brahmin/Chhetry group whereas, Janajati group had 1.9% (n=31) among public schools and 2.9% (n=12) among private schools.

Caste/ethnicity	Total		Public		Private	
	Total	RE, N (%)	Total	RE, N (%)	Total	RE, N (%)
Dalit	441	12 (2.7)	346	7 (2)	95	5 (5.3)
Janajati	2084	43 (2.1)	1670	31 (1.9)	414	12 (2.9)
Disadvantage non dalit	24	3 (12.5)	7	2 (28.6)	17	1 (5.9)
Brahmin/ Chhetry	2572	115 (4.5)	1132	40 (3.5)	1440	75 (5.2)
Total	5127	173 (3.4)	3159	80 (2.5)	1968	93 (4.7)

Table 3: Caste/Ethnicity wise distribution of refractive error.

Among children who spent outdoor time less than 1 hour per day had higher proportion of myopia N= 88 (3.6%) whereas children spending more than or equal to 1 hour had lower proportion of myopia N=15 (0.8%) which is statistically significant p<0.001 OR 4.6 (CI 2.7-8.0).

Outdoor time	Myopia	No Myopia	p	OR
	N (%)	N (%)		
< 1 hour	88 (3.6)	2362 (96.4)	<0.001	4.6 (2.7 - 8.0)
1 to more	15 (0.8)	1867 (99.2)		

Table 4: Proportion of Myopia and outdoor time spent by children.

In public schools, 3 children were advised to continue same prescription, 1 child was advised to change prescription, and 44 children were prescribed new spectacles. In private schools, 12 children were advised to continue same prescription, 5 children were advised to change prescription, and 45 children were prescribed new spectacles.

4.Discussion

This study compares refractive error prevalence in public and private school children in Dhangadhi sub metropolitan city in Far West Nepal. We found that the prevalence of refractive error among private school children (4.7%) was almost double to that of public-school children (2.5%). In a retrospective study in 2010, refractive error prevalence was 2.06% among public school children of Far West Nepal [16]. This shows refractive error prevalence has not increased largely among public school children. In another study from Jhapa district, refractive error was lower (7%) in public school children in comparison to private school children (10.3%) [14]. In study from Jhapa, there was small sample size with convenience sampling. As reported elsewhere in literature, higher prevalence of refractive error among private school children could be due to the reason that private school children spend more time indoor doing their schoolwork's, playing mobile games and less time outdoors. As prevalence of refractive error is almost two times to that found in public school children, it is necessary that different strategies to reduce the effect of excessive schoolwork and mobile games should be adopted for school vision

screening programs among public and private schools with more preventive measures among private schools. Morgan et al., reported that myopia develops in a myopiogenic environment and most of the school myopia is due to the environmental factors [10].

It is likely that private school children start going to school at younger age than the public-school children which is supported by higher mean age among private school children (females: 11.1 ± 2.8 years and males: 11.2 ± 2.9 years) in comparison to public school children (females: 12.9 ± 3.0 years and for males: 13.2 ± 2.9 years). Among public school children myopia was highest among 13 years old (2.6%) whereas among private school children highest myopia was in 17 years old (8.5%) which could likely be due to more reading work during secondary school. A study in Jhapa district found that refractive error prevalence was highest among 14-16 years old age group [14].

The proportion of refractive error among female children was 60% (n=48) in public schools and 37.6% (n=35) in private schools which was comparable with the proportion of total children in the study population (public school: 55.1% and private school: 39.7%). Sapkota et al. found that female had higher prevalence of visual impairment due to refractive error (22.1%) in comparison to males (17.68%). Contrary to this, study in Jhapa district among school children found slightly higher prevalence of refractive error among male (9.8%) in comparison to female children (7.5%) [14].

Caste/ethnicity wise distribution of refractive error found that highest prevalence was among Brahmin/Chhetry group (public school 3.5% and private schools 5.2%) whereas lowest prevalence was among Janajati group (public school 1.9% and private schools 2.9%) accounting for almost half of the children with refractive error. A study done in western Nepal found that Chhetry had the highest prevalence of refractive error whereas lowest prevalence was among Gururng caste/ethnic group [17]. Unlike in eastern Nepal, in our study population the proportion of Mangoloid group was low. Disadvantage non dalit were fewer in number in public (n=7) and private school (n=1), so meaningful comparisons could not be made.

Myopia was associated with less outdoor activity with larger proportion of myopia among children spending less than 1 hour in outdoor activity, 3.8% (n= 88) in comparison to children spending more than 1 hour in outdoor activity, 0.8% (n=15). Studies have reported that outdoor activity prevents myopia onset and development [19]. Increasing time spent outdoors, (two additional 20-minute recess program outside classroom) prevented myopia onset and progression among children aged 6-14 years in northeast China [19]. Another study found that addition of 40-minute outdoor activity in school in comparison to regular school activity resulted in reduced myopia incidence over the 3 years period [20]. A study from Australia found that Australian children were exposed to more daily outdoor light in comparison to Singaporean children which could be a contributing factor for myopia development [21].

5. Conclusions

The prevalence of refractive error among private school children is two times to that in public school

children. The schooling system with less outdoor activity could be responsible for higher refractive errors among private school children. Public health initiatives to increase outdoor activity in private school children might be necessary to reduce the progression of myopia. Regular school screening program is necessary to detect the refractive error in children in early age and this will help to prevent children from developing amblyopia.

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Conflicts of interest

None

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