

Research Article

Refractive Errors in Private Schools; A Cross-Sectional Study

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Abstract

Objectives: The objective of this study was to quantify the magnitude of refractive errors in private sector high school children of Lahore, Pakistan.

Methods: This analytical, cross sectional study was conducted in private schools of Lahore during the period of August to December 2017. Multistage simple random sampling was adopted for the selection of study subjects. Screening of refractive errors was managed in the schools according to defined protocols. The data was collected on the pre-tested questionnaire, entered into the version 23 of IBM SPSS and analyzed by the use of statistical tools.

Results: Out of the total, 1000 study subject, 500 (50%) were boys, 500 (50%) girls, 500 (50%) from rural and 500 (50%) from the urban areas. The age ranged between 9 to 18 years with a mean of 13.01 ± 1.84 . Refractive error was present in 168 (16.8%) of the participants. Myopia was the leading type (52.4%) followed by astigmatism (25.6%) and hypermetropia (22%). Gender and urban based results were found significant at p value of < 0.05 (< 0.001) and (0.001) respectively with a high prevalence in girls and urban areas.

Conclusion: Refractive errors are prevalent among a considerable number (16.8%) of the private school children at Lahore. There is a significant difference among the boys, girls, rural and urban settings. High prevalence is found among female students and urban areas.

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Introduction

Refractive error is a major public health problem affecting the global community, especially school children in developing countries. These errors affect a huge part of the global population and considered as the leading cause of vision impairment resulting in decreased educational opportunities, efficiency, and quality of life.¹ The issue in students at

schools pose a potential threat to the academic achievements of the children and ultimately lead to the problems related with human resource development. The problem multiplies many folds due to lack of required eye care services and basic knowledge about the management measures. It is worth mentioning that the solution is simple and a low-cost health care intervention.

The malfunction of eye to properly focus light rays from an object to retina leads to refractive errors.² As a result, the perceived image of the object is blurred requiring correction for a clear vision. These errors are classified into three different types including myopia, hypermetropia and astigmatism.² In myopia the light rays coming from infinity focus in front of the retina where as in hypermetropia light rays focus behind the retina with accommodation at rest. However, astigmatism leads to blurred vision due to different refractive power of the cornea or lens in different meridians which prevent the light rays from focusing to a single point.

World Health Organization estimates that the global figure of visually impaired people is around 285 million including 39 million blinds and 246 million with low vision.³ Refractive errors (43%) had been concluded as the major cause of visual impairment and children are at higher risk which is consequential to learning disabilities.^{4,5} Different studies among the school children, such as in Bangalore, India concluded a prevalence of 10% whereas the prevalence found in different relevant studies from Pakistan was 19.8% in Lahore, 20.43% in Kohat, 17.24 % in southern Punjab and 21.7 in Lahore respectively.^{6,9} Another study revealed a prevalence of 20% among the public sector high school students at Lahore.¹⁰ Similarly, a research about the refractive errors among students of a religious school (Madarassa) at Harripur concluded a prevalence of 41%.¹¹ A significant impact of the visual acuity on the academic performance of school students has been concluded in a Nigerian study.¹²

Children are considered as the most important natural resource and the school age is related with maximum potential used for the future physical and intellectual growth. Their health, knowledge, skills and liveliness will establish the future of national and international community. The career of any child is highly reliant on the vision and vision related activities. This demands an early detection and management of refractive errors to prevent the forthcoming frightening disabilities.

Lahore is the second largest city of the country, provincial head quarter and a historic cultural center of South Asia. The city is known as the educational capital of Pakistan and the largest producer of the

professionals in different fields. Private education is a global phenomenon and a significant number of school aged children are getting educational services from these schools. The city is having maximum number of public and private sector educational institutions. Similarly, a large number of major private school networks scattered in different areas of the country are Lahore based. There is a wide range of these private school networks having different level of educational services and fee structure. The reasonable socio-economic status of the parents, availability of financial resources and comparatively perceived better level of awareness regarding child health was the major reason to plan this research. The objective of this study was to quantify the magnitude of refractive errors in private sector high school children of Lahore, Pakistan.

Methods

It was an epidemiological, cross sectional, descriptive study conducted in the high schools of Lahore Pakistan. All the private schools in rural and urban areas were included in the study. The students of both genders from class 6 to class 10 were included whereas the students having ophthalmic infections, visual acuity less than 6/60 and coexisting organic defects in the eye were excluded from the study. The study remained continued during the period from August to December 2017. Multistage random sampling technique was adopted to select the study subjects.¹³ In first stage, a list of five Tehsils in Lahore was obtained and one was randomly selected. In second stage, a list of the number of union councils in the selected Tehsil was obtained from the concerned office and one union council from urban and one union council from rural setting were randomly selected. In third stage, a list of private high schools in both the union councils was obtained from the relevant authorities. The schools were categorized on the basis of fee structure and a list was prepared. The category of schools having an average monthly fee between Rs 2500 to Rs 5000 were segregated and an equal number both from urban and rural setting were included in the study. A total 100 students including 50 boys and 50 girls were randomly recruited from each class 6 to 10.

The sample size was calculated by the Open Epi Tool kit and following formula was used;¹⁴

α	Level of significance	95.00%
P1	Expected Proportion of children with refractive error	20.00%
d	expected error	6.00%

$$n = \frac{Z_{1-\frac{\alpha}{2}} P(1 - P)}{d^2}$$

n	Sample size in one group	171
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The estimated sample size for each group was 171 study subjects. However, to increase the strength, accuracy and precision, 250 subjects were included in each group leading to a total of 1000 study subjects as presented in figure 1. Screening of refractive errors, according to the defined protocols with required instruments (Snellen charts, refraction boxes with trial frames, auto refractometer (model 4 RK 700 Korea), retinoscope, ophthalmoscope and hand-held slit lamp etc) and logistics by a team of optometrists supervised by an ophthalmologist was managed in the schools. Visual Acuity (VA) of the study subjects was evaluated with the Standard Snellen Chart placed at a distance of six meters. Students with VA less than 6/9 in the better eye or both eyes were tested for the presence of refractive error by a pinhole. The improvement of the vision with pinhole examination was followed by auto and subjective refraction. It was also cross-checked by retinoscopy. Informed consent was obtained and data was collected on a structured, pre-tested questionnaire. The questionnaire was prepared to gather the information related with the objective of the study. It was discussed with the experts in Ophthalmology to establish the face and content validity. Later on, the questionnaire was pretested for reliability testing. Necessary changes were made before the collection of data. The data was organized, entered in version 23 of IBM SPSS and analyzed by the use of statistical tools. Ethical approval of the study was obtained from the Institutional Ethical Review Board (IERB) of The University of Lahore.

Results

A total, 1000 students from private high schools of Lahore were included in the study. Out of the participants, 500 (50%) were boys, 500 (50%) girls, 500 (50%) from rural and 500 (50%) from the urban areas. The age of the respondents ranged between 9 to 18 years with a mean of 13.01 ± 1.84 . Refractive

error was present in 168 (16.8%) of the study subjects whereas 832 (83.2%) were not having these errors of refraction. Myopia was found as the leading type (52.4%) of refractive errors followed by astigmatism (25.6%) and hypermetropia (22%) respectively. The gender and area-based results of refractive errors prevalence are presented in Table 1. Gender based results shows that the prevalence is high in girls (62.5%) as compared to boys (37.5%). The p value calculated through chi square test (<0.001) represents a significant association of refractive errors with the gender of school children. Similarly, the prevalence in urban areas is more (61.9%) than the rural areas (38.1%). The p value of < 0.05 (0.001), calculated through chi square test is showing that magnitude of refractive error is significantly associated with area of the students.

Family history of glasses including father, mother, brother and sister was studied. These results were compared with the prevalence of refractive errors and presented in Table 2. Odds ratio was calculated to determine the strength of association between these variables. The odds ratio of father (OR= 1.89) and mother (OR = 1.52) history of glasses with refractive errors prevalence conclude a positive risk of disease. Similarly, the calculated p value of (0.002 and 0.03) is presenting a significant association between father/mother history of glasses and prevalence of refractive errors in the study participants. The odds ratio (1.32) of brother and sister (OR= 1.35) history of glasses could also be a risk factor but the association is very weak association. Similarly, the calculated p value of brother (0.35) and sister (0.22) represent that there is no significant association between refractive errors and brother/ sister history of glasses.

Table 1: Gender and Areas-Based Prevalence of Refractive Errors

Variable	Refractive Error		Total	P-value
	Yes (n=168)	No (n=832)		
Male	63 (37.5%)	437 (52.5%)	500 (50%)	
Female	105 (62.5%)	395 (47.5%)	500 (50%)	<0.001
Rural	64 (38.1%)	436 (52.4%)	500 (50%)	
Urban	104 (61.9%)	396 (47.6%)	500 (50%)	<0.001

Table 2: Family History of Glasses and Refractive errors in School Children

History of Glasses	Refractive Error		Total 1000	OR* (95%CI)	P-value
	Yes (n=168)	No (n=832)			
Father	Yes	43 (25.6%)	128 (15.4%)	171 (17.1%)	1.89 (1.27-2.80)
	No	125 (74.4%)	704 (84.6%)	829 (82.9%)	
Mother	Yes	47 (28.0%)	169 (20.3%)	216 (21.6%)	1.52 (1.04-2.22)
	No	121 (72.0%)	663 (79.7%)	784 (78.4%)	
Brother	Yes	17 (10.1%)	65 (7.8%)	82 (8.2%)	1.32 (0.75-2.33)
	No	151 (89.9%)	767 (92.2%)	918 (91.8%)	
Sister	Yes	29 (17.3%)	111 (13.3%)	140 (14.0%)	1.35 (0.86-2.12)
	No	139 (82.7%)	721 (86.7%)	860 (86.0%)	

(*OR= Odds Ratio)

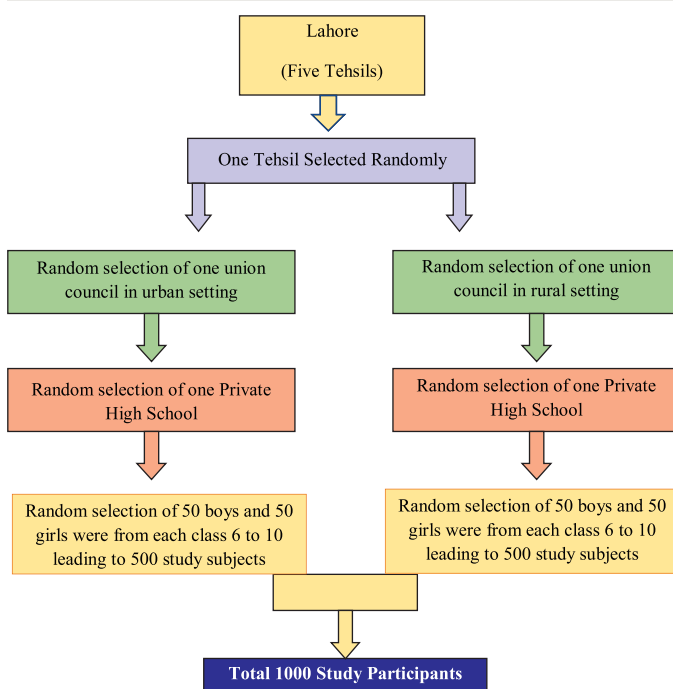
Table 3: Cross Tabulation of Seeing the Board and Visit to Eye Care Professional

Can student see the board clearly?	Yes	No	Total	
Any visit to eye care professional	Yes	140	70	210
	No	666	124	790
	Total	806	194	1000

The calculated p-value is <0.001, which is significant at $p < .05$

the total 2.3 billion people with refractive errors only 1.8 billion can access the affordable examination and correction.¹⁵ So, accessibility and affordability are a major problem but it is also worth mentioning that management is among the most cost-effective interventions in health care.¹⁶

In our study it was found that 168 (16.8 %) of the study subjects were having refractive errors. The prevalence of refractive errors found in this study is contrary to the findings of similar studies in Ghana & Nepal concluding the prevalence of (3.25%) and (10.35%) respectively.^{15,17} The low prevalence in Private school of Ghana may be due to difference in methodology as the current study subjects were comparatively older children and cycloplegic refraction was not performed.¹⁵ The results are also contradictory to the findings of other studies concluding a prevalence of (21.7%) and (20.07%) in Lahore based high schools studies.^{9,10} But it is important to mention that these studies were conducted in public sector schools. The results of another study from Kingdom of Saudi Arabia (13.7%) are closer to findings of this study.¹⁸ Similarly, the results of a school-based research from Iran (14.9%) coincide with the finding of present study. The methodology of this study was similar to the present research as cross sectional design and random sampling was used.¹⁹ The findings of current study contrast the prevalence of refractive errors (33%) at Baghdad, Iraq but this study was conducted among the medical students.²⁰

**Figure 1:** Flow diagram of the selection of study subjects

Discussion

Refractive error in school children is an important public health concern especially in developing countries. The issue has been discussed in literature but the studies are generally related with the public-sector schools. It is among the priority areas of the global initiative "Vision 2020".¹⁵ Worldwide, out of

Myopia was found as the primary type (52.4%) followed by astigmatism (25.6 %) and hypermetropia (22%). Although some relevant studies also conclude myopia as a major type of refractive errors but there is a variation of results among different studies concluding myopia as (61.7%), (43%) and (65.7%) respec-

tively.^{7,10,18} It is generally perceived that the over usage of smart gadgets is related with the problems of refractive errors. However, this perception needs a scientific based valid evidence to consider it as an etiological factor. The gender and area-based results present that the prevalence is high in girls (62.5%) as compared to boys (37.5%) and results are significant at a p value of < 0.05 (< 0.001). Similarly, the prevalence in urban areas is more (61.9%) than the rural areas (38.1%) and findings are significant at p value of < 0.05 (0.001). These gender based results are consistent with the findings of a relevant study reporting high prevalence among the female study subjects.¹⁸ However another study conclude a high magnitude among the male participants.^{21,22} The urban areas hold a significantly high magnitude of the problem in present study. The results are contrary to the finding of another research concluding significantly high prevalence among the students of rural settings.¹⁸ A very important finding of the present study is presented in Table 3 comparing the ability of the student to see the board and any visit to eye care professional for examination. The results are significant at $p < .05$ (< 0.001). Out of the 194 students who reported that they were unable to see the black board, 36% never visited any eye care professional for examination and management.

The present study was conducted in Lahore among the private sector schools. Lahore is the second largest city of Pakistan with approachable and affordable eye care services. Similarly, the parents of the students in private sector have a better financial affordability. The findings demand a comprehensive screening programs with a focus on both the private and public schools. Moreover, the issue is not only related with accessibility and affordability but an eye care education project for the parents, teachers and students would be more effective and efficient. The limitation of this study includes the lack of data about the use of modern technology gadgets to associate it refractive errors which is more among urban students and to find out other factors.

Conclusion

This study concludes that the refractive errors affect a considerable number (16.8%) of the private school children at Lahore. There is a significant difference among the boys, girls, rural and urban settings. High

prevalence is found among female students and urban areas. Financial affordability and accessibility are the contributory factors but major issue is related with eye care literacy among parents, teachers and students.

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