Prevalence of refractive errors in school children aged 11-15 years in Jalalabad city of Nangarhar province, Afghanistan – a cross-sectional study

Assistant Professor Dr. Mohammad HarisAbdianwall
Associate Professor Dr. Gholam Farooq Rahimi

Lecturers of ophthalmology departments, Faculty of Medicine, University of Nangarhar

Abstract

Introduction: the purpose of the study was to estimate the prevalence and types of uncorrected refractive errors (URE) among school-going children aged 11-15 years in Jalalabad City of Nangarhar Province.

Methodology: the study was population-based descriptive cross-sectional in design, conducted between 01-September-2007 and 10-October-2007 in schools of Jalalabad City. The sample size was calculated as 1034 and a two-stage cluster sampling method was used for data collection. In the first stage, 4 schools were selected and in the second, classes were randomly selected. A structured, pretested and self-prepared questionnaire was used for data collection. Visual acuity (VA) of the students was recorded using Snellen's test type in the daylight and each eye was examined separately. Students with VA less than 6/12 were examined and non-cycloplegic refraction was performed using auto-refractometer for types of refraction. Data were analyzed using Epi-info, descriptive statistics of the variables were presented by giving number and percent using table and chart.

Result: The sample size was 1034, we invited 960 students (580 males and 380 females), 951 (92.0%) students participated in the study. The prevalence of URE was found out as 5.5% (95% CI, 4.1% - 7.2%). In male students, the prevalence of URE was discovered as 28 (4.9%) while it was found to be 24 (6.4%) in female students. The prevalence of different types of RE, myopia, hyperopia, and astigmatism was found to be 2.8%, 1.4%, and 0.5% respectively.

Conclusion: the prevalence was found to be high among students in Jalalabad City and the single cause of lower VA was URE. Lack of school eye health programs and limited availability or unequal distribution of the eye care services increase this problem. Integration of school eye health in the school health programs and performing mass school screening in rural and urban areas are recommended. Furthermore, for the proper estimation of URE in the whole Nangarhar Province, performing a survey of cycloplegic refraction with a representative sample size was recommended.

Key words: Prevalence, Refractive error, school going children, Afghanistan

Introduction

Globally, 285 million people of all ages were estimated as visually impaired and the major cause of visual impairment is URE (43%) (1). URE is a significant cause of avoidable visual disability and visual impairment, especially in developing countries (2, 3).

Worldwide, it was estimated that over 40 million school-age children have visual acuity =< 6/12 from uncorrected or improperly corrected refractive errors. The highest prevalence is in the most developed urban areas in South-East Asia and in urban areas in China, with more than 9 million children with an unmet need for correction. This is consistent with the high prevalence of URE in Asian children, especially with the high prevalence of myopia (4).

Of children, 5 -15 percent are considered to have refractive errors, the majority of which are uncorrected, and that there is currently a need for population-based studies to ascertain these figures (5). The estimate of the global prevalence of the refractive errors in school-age children 5-15, which was derived from the available data and from extrapolations of the data to other countries or regions shown, that Africa has the lowest prevalence (0.85%) and Southeast Asia has the highest prevalence (8.7%) (4).

In Nangarhar province, the prevalence of visual impairment was found as 22.6% (95%CI, 20%-25%) among people aged 50 years and above, of which 13.9% (95%CI, 12%-16%) was the low vision and 8.7% (95% CI, 7%-10%) was blindness. The second most common cause of VI was URE (26.9%) (6).

The distribution of disabling refractive errors is dependent on the rural/urban distribution of the population especially in developing countries: rural areas have a lower prevalence of DRE (Disabling Refractive Errors) than urban areas by a factor of 2 to 4.5 (4).

Blindness due to uncorrected or inadequately corrected RE starts at a younger age than cataract, which manifests itself in old age (7). If the impact of blindness due to refractive error is considered in terms of blind-person-years, a person becoming blind due to refractive error at a young age, and which is not corrected, would suffer many more years of blindness than that of a person becoming blind from cataract in old age and would place a greater socioeconomic burden on society (7).

Blindness and visual impairment among adults in the family may result in decreased school attendance and performance. For instance, blind adults in many low-income countries are dependent on school-age children and other family members (8). People living with a disability may be equally or more exposed to risk factors that lead to infectious diseases and have limited access to outreach and treatment services (8).

Visually impaired people had a higher prevalence of depression compared with people with good vision. Of visually impaired older people, 13.5% were depressed compared with 4.6% of people with good vision (age and gender-adjusted OR, 2.69; 95% CI, 2.03-3.56) (9). The life expectancy of the blind persons is one-third less than that of their sighted peers and most of them dies within 10 years of becoming blind. Blindness not only causes human suffering but is also causes increased mortality (10).

Blindness (childhood or adult) is of major economic and social consequence the family, the community and the nation. It is usually costlier to educate partially sighted and blind persons than their normally sighted counterparts. Also, rehabilitation of the visually impaired person is quite expensive, relying on interdisciplinary professionals or Para-professionals to provide effective services (11). The analyses predicted that the direct costs of treating eye disease in Australia in 2004 would be 1.3 billion more than the cost of managing coronary heart diseases, stroke, arthritis, or depression nationally in that year and more than would be spent on diabetes mellitus and asthma (two of the Australian National Health Priority areas) combined. Indirect costs were predicted to add another USD 5.6 billion to the annual national eye care bill for 2004 (12).

The correction of refractive errors to eliminate this form of avoidable disability has been included as a priority component within the planned areas of action under vision 2020, the right to sight, and the global initiative for the elimination of avoidable blindness (2). At the community level, the priority groups for the provision of refractive services are children aged 11-15 years with myopia and people over the age of 40-45 years who require spectacles for near vision (2).

Although Vision 2020 (the current WHO. Global initiative) imposes a mandate to correct refractive errors, little infrastructure, and few resources are available to accomplish the task of correcting refractive errors (5).

There is no data about a refractive error in Jalalabad city, so this survey aims to provide ideas about the prevalence of RE and type of RE among school-going children aged 11-15 years, which will be helpful for future eye care plan and intervention. This information can also be used for making an action plan for human resource development and the provision of technological infrastructure for reducing visual impairment due to refractive errors. Therefore, the study was designed to estimate the prevalence of refractive errors in schoolchildren aged 11-15 years in Jalalabad city of Nangarhar province, Afghanistan.

Methodology

The study was descriptive cross-sectional, conducted in the Jalalabad City of Nangarhar Province from 01-September-2007 to 10-October-2007.

The maximum sample size was calculated as 1034 by the following measure taken in to account. The confidence level was taken as 95%, marginal of error as 3.0%, expected prevalence of refractive errors as 50%, design effect as 1 and total population aged 10-15 years as 32340. These all together put into the formula calculating sample size for population proportion in the Open-Epi online sample size calculator.

The two-stage cluster sampling method was used for data collection. In the first stage of sampling, four schools (two male schools and two female schools) were selected randomly from the list of 16 schools located in different parts of the Jalalabad City. In each class, there were 25-30 students, therefore, two 5th, two 6th, two 7th, two 8th and two 9th classes were selected

randomly from the classes of each sampled school. All students in each class were targeted we could have invited 960 students from all four schools to participate in the study. Totally, 951 (92.0%) students have accepted participation, 9 (0.9%) students refused to participate and 74 (7.2%) students were absent on the day of the survey.

The self-prepared questionnaire, composed of two parts, socio-demographic characteristics, and eye examination were used for data collection. In the first part, some socio-demographic characteristics (name, sex, and age) were asked and in the second part, eye examination (recording of visual acuity (VA) without and with pinhole, type of refractive errors (hyperopia, myopia, and astigmatism), utilization of the spectacles, and other causes of visual impairment (VI) were noted after eye examination.

For data quality assurance, a pilot study was conducted in Abdurrahim Niazi high school, one of the non-sampled schools in Jalalabad City and some corrections were made in the questionnaire accordingly. In addition, three-day training about the aims and objectives of the study, how to record VA, and filling out the questionnaire was conducted in the Ophthalmology Department of Nangarhar University Hospital for the study team (consisting of two ophthalmic technicians, two ophthalmic nurses and an ophthalmologist). Each member was given standardized instruction on the definition, recording visual acuity, inclusion and exclusion criteria, and examination protocol. Furthermore, data recorded in the field survey were rechecked in the field for necessary corrections by the field surveyor.

All the students of class 5, 6, 7, 8 and 9, which were selected by the simple random sampling were included in the study, however, students who were absent and refused to participate were excluded from the analysis of the study.

School to school survey was conducted, VA of the students was recorded using Snellen's test type in the daylight and each eye was examined separately. Students with VA less than 6/12 (in the worst or in the better eye) were carried out to the department of ophthalmology University Hospital at the end of each day. Eye examination and non-cycloplegic refraction were performed using an auto-refractometer for the students with VA less than 6/12 in the hospital, questionnaires were filled out and the students were transported back to the schools. However, the questionnaires were filled out in the schools when the subject's VA was better than or equal to 6/12. A student who was wearing spectacles, VA was recorded with spectacle. The subject who was absent at first visit considered as absent and who had other common eye ailment was given medicine.

Data were analyzed using Epi-info in the Pakistan Institute of Community Ophthalmology, Peshawar University. Descriptive statistics of the variables were presented by giving numbers and percent using tables and charts. VA less than 6/12 in the better eye considered as visual impairment.

Myopia was defined as refractive errors =< - 0.5D, hyperopia as refractive error => + 2.00D and astigmatism as refractive error = > + or -1.00D.

Ethical permission was obtained from the ethical board of the Nangarhar Medical Faculty, besides permission was taken form university chancellor, health director and education director

in Nangarhar province. Furthermore, each school's principles and students were consented before, starting of the interview.

Results

The total sample size was calculated as 1034, we invited 960 (580 males and 380 females) students but 951 (92.0%) students accepted participation in the study. Generally, 74 (7.2%) students were absent on the day of the survey and 9 (0.9%) refused to participate in the study. The response rate is higher in female 377 (96.6%) than male 574 (93.0%). From the absent students, 50 (67.6%) were females and the remaining were males while from students who refused to participate, 3 were female and 6 were male. VA was performed for 86.9% students while refraction was performed for 5.0% of the students (Figure. 1)

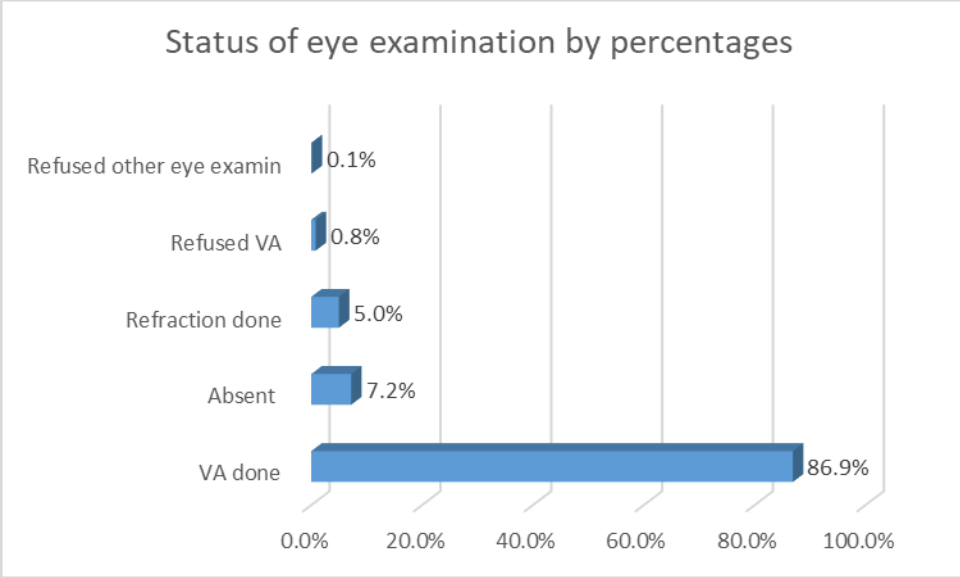

Figure 1. Shows status of eye examination by percentages

Among the study participants, the proportion of 15 years old students were the highest (30.4%), while the proportion of 12 years old students where the lowest with 11.9%. The proportion of 11 years old, 13 years old and 14 years old were 16.4%, 23.0% and 18.3% respectively (Table 1).

Tables 1: shows the distribution of students by age and sex

Age	Male		Female		Total	
	N	%	N	%	N	%
11 y	156	27.1	0	0.0	156	16.4
12 y	30	5.2	83	22.1	113	11.9
13 y	102	18.1	114	30.5	216	22.7
14 y	144	25.2	30	7.9	176	18.5

15 y	142	24.5	150	39.5	292	30.7
total	574	60.4	377	39.6	951	100.0

In this study, only 0.4% of the students were using spectacles during the study. The study found that the prevalence of refractive error among school-going children aged 11 – 15 years was 5.5% (95% CI, 4.1% - 7.2%). In male students, the prevalence of RE was discovered as 28 (4.9%) while it was found to be 24 (6.4%) in female students. The lowest prevalence of RE (3.7%) was among students aged 13 years old (among 7th class students), however, the highest prevalence (7.1%) is among 12 years old (among 6th class students) students. The prevalence of RE among other students is illustrated in Figure 2. The prevalence of myopia was found to be 2.8%, hyperopia 1.4%, an-isometropia 0.7%, and astigmatism 0.5%.

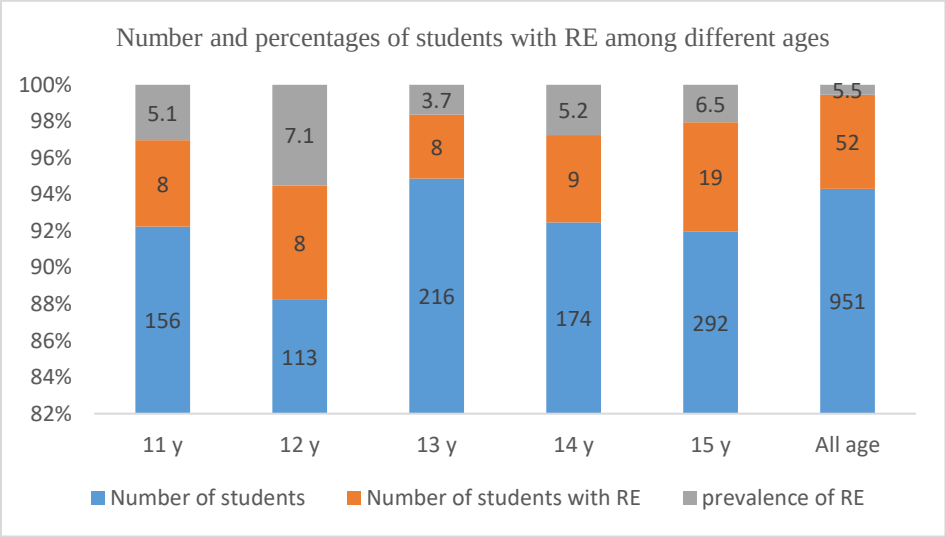

Figure 2. shows the frequency of students with refractive errors in different age group:

It was discovered that more than half of the RE was myopia, followed by the hyperopia, an-isometropia and astigmatism (Figure 3.). Generally, the prevalence of myopia is the highest among 15-years old students 14 (4.9%) whereas the lowest prevalence was found at 11-years old students 2 (1.3%). The prevalence of myopia in 12, 13, and 14 years old students were 3 (2.7%), 4 (1.9 %) and 4 (2.3%) respectively. In contrast, the highest prevalence of hyperopia was found among student with aged 11and 12 years, it was respectively 5(3.2%) and 4 (3.5%) and followed by the 1.1% and 0.7% which were observed respectively among student aged 14 and 15 years old. Generally, the prevalence of myopia, hyperopia and an-isometropia is higher among female than male students in the sampled school. The prevalence of myopia was found as 3.7% among female which is almost twice as much as male students (2.3%). The prevalence of hyperopia and astigmatism were 2.4% and 1.1% respectively among female which is higher compared to male students which is 0.7% and 0.5% respectively. Unlikely, the prevalence of astigmatism was found to be almost two times higher among male (0.7%) than female students (0.3%).

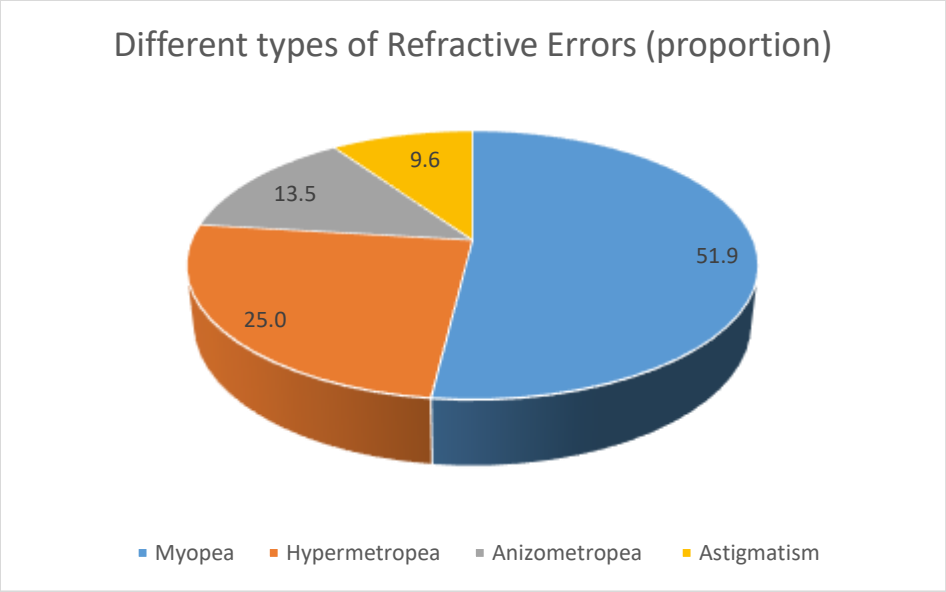

Figure 3. illustrate the proportion of different types of RE

Among the students with refractive errors, 42 (80.8%) were not using spectacles, 7 (13.5%) were using spectacles irregularly and 3(5.8%) were left using spectacles. In terms of causes of not using spectacles, 42 (88.8%) reported that the spectacles were not prescribed, 2 (3.8%) students reported that the spectacles were not comfortable, 2 (3.8%) reported that the spectacles were broken and 6 (11.5%) reported that they shy when they were using spectacles.

Discussion

From the total calculated sample size (1034), we achieved 960 (580 males and 380 females) students and 951 (92.0%) accepted enrolment. The number of absent students were 74 (7.2%), 50 (67.6%) male and 24 (32.4%) female while 6 male student and 3 female students refused to participate into the study. Higher absence rate among the sampled school might be due to immediately beginning of the survey after the starting of the school from summer vacation, and the first two surveyed schools were females' schools, therefore the higher number of absence students were recorded there.

The study found that the prevalence of refractive error among school-going children aged 11 – 15 years was 5.5% (95% CI, 4.1% - 7.2%). The prevalence is much higher if we compare it to Gadap Town, Karachi, Pakistan which is 2.86% (13) and conducted at the same age group 11 – 15 years. And also it is higher when we compare it with the study which was conducted at the age group of 11 – 15 years in Banu District, northwest Frontier Post, Pakistan which is 3.3% (95% CI, 2.6% - 4.02%) (13). Furthermore, it is higher even if we compare it to India (Moderate visual impairment in India: The Andhra Pradesh Eye Disease Study) which is 3.71% (95% CI, 3.11% - 4.30%) (14). The reason for the high prevalence in the study could be not the availability of community eye care programs.

The prevalence in this study is much lower if we compare it with Kolkata 25.5% (15), Cairo which is 22.1% (16) and Singapore which is 22.3% (95% CI, 19.0% - 25.5%). The high prevalence of refractive errors in those studies might be due to the difference in the sample size, study population, environmental factors, and diverse ethnicity.

The prevalence of refractive error in this study is higher in female 6.2% (95% CI, 4.2% – 9.5%) then male 4.9% (95% CI, 3.3% – 7.1%). The prevalence of refractive error is also higher in female 24.73% than male 25.54% in the prevalence study of school children in Kolkata (15). in contrast, the prevalence of refractive errors is higher in males (5.09%) than females (4.02%) in the study of Chiang Mai Municipal areas (17). In our society, the priorities have been given to the male students and male students have more access to health services or eye care services, therefore, I think this might be a contributing factor to a high prevalence of RE among females.

The most common type of refractive errors are myopia 51.9%, followed by hyperopia 25%, an-isometropia 13.5%, and astigmatism 9.6%. In this study, the prevalence of myopia was 2.8% and it is higher in females (3.7%) than males (2.3%). Several studies in the world such as study of rural southern china (18), refractive errors among school children conducted in Chiang Mai (17), the Andhra Pradesh Eye disease study conducted in India (14), magnitude and determinants of refractive error conducted in Omani school children (19) support the result of this study. On the other hand, it is higher in males than females in some papers, such as the study on refractive error among school children in Kolkata (15). Besides, in the study of refractive error and visual impairment conducted southern china (18) the distribution of myopia is the same in both sexes.

The prevalence of myopia is the highest 14 (4.9%) among 15-years old students, while it is the lowest 2 (1.3%) among 11-years old students. This study follows the fact that the prevalence of myopia is increasing as children grow older and this might be due to elongation of the eye axial length (17). A number of studies conducted in different countries followed the same facts (18-20).

In this study, the prevalence of hyperopia was 1.4%, however, it was more than three times higher among the female (2.4%) than male (0.7%). This study was consistent with some other studies conducted in the world (19, 21). The prevalence of hyperopia was the highest among 11 and 12 years old students and it was decreasing by the increasing of age, the lowest was found among 15 years, old students. This pattern of Hyperopia is the same if we compare it to the study of refractive error and visual impairment in Africa (22), the study of refractive error in children in an urban population of New Delhi (23), the study of refractive error and visual impairment in urban children conducted in Southern China (20), the study of refractive error and visual impairment in school children conducted in rural southern China (18). However, in a study conducted in Malaysia, found out that the pattern was not changed and remained constant in all ages from 11 years to 15 years old students (21). Similarly, in another study conducted in Omani school children, the prevalence of hyperopia is increasing by the increasing of the age (19).

The prevalence of spectacle utilization in sampled schools was 4 (0.42%), which is very low if it is compared with Iran 4.8% (24) and southern India 17% (25). This difference might be due

to lake of awareness about the refractive error, its consequences, its influences on quality of life, its contribution to the blindness and visual impairment, socio-culture factors, and not availability, affordability, accessibility of eye care services in this society.

If we consider the number of eyes, 135 (6.9%) eyes had VA of less than 6/12. The common causes of VA less than 6/12 were refractive error 71.8% (97), followed by unexplained 8.1% (11), corneal opacity 7.4% (10), trauma 7.4% (10), posterior segment disorder 4.4% (6) and strabismus 0.7% (1). Among students in Jalalabad city, I couldn't find a single student with visual acuity less than 6/12 in the better eye due to other causes rather than refractive errors. It means the refractive error was the single cause of visual acuity less than 6/12 in the better eye among school children aged 11 – 15 years in the sampled schools of Jalalabad city.

The prevalence of Refractive Error was high in Jalalabad city of Nangarhar province because there was a lake of awareness among the teacher, parents, and students regarding the problem of refractive error and its feasibility of the solution. In addition, there is no regular and effective program for creating awareness about refractive errors in the community. Since parents and teachers don't know the hazard and consequences of refractive error to the school-going children. Due to scarcity of accessible, affordable, equitable and appropriate optical services, a large burden of uncorrected RE needed an intervention, which would definitely have an impact on their socio-economic development and quality of life.

Many countries have included eye health care program in general medical examinations for their national health programs (17). I agreed that early detection of eye problems in younger children will provide an early provision of spectacles and better prognosis. It is hoped that this study will provide information for the planning of a comprehensive eye care program in an urban area of Nangarhar province of Afghanistan.

It is important to note that there was no proper school screening program in the country, therefore much attention is needed by the ministry of health to adopt and develop a screening program to reduce the burden of uncorrected refractive error and enable the school children to increase their educational potential and learning capacity.

As non-cycloplegic refraction was performed in this group, many students were left out of proper diagnosis. This could be count as the restriction of the study.

The prevalence of Refractive was high in the age group of 11-15 years old students in the Jalalabad city of Nangarhar province. The unique cause of visual impairment in this group is RE, and the lack of comprehensive eye care program intensifies the problem. Performing mass school screening in the rural and urban areas and the adoption of accessible, affordable, equitable and appropriate refractive services is recommended.

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