

Prevalence of Refractive Errors Among Primary School Children (6-15 Yrs) In Al-Khartoum- Sudan

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ABSTRACT

Objective: This study aimed to determine the prevalence of refractive errors and visual impairment among primary school children in Khartoum city, Sudan.

Methods: This is a cross sectional study. Children of the primary schools in Khartoum with age range of 6-15 years were included. School children were first screened at the school premises for refractive error and visual acuity. Children detected with defective vision were further evaluated employing subjective refraction with auto refractometer.

Results: The study included 400 pupils. Prevalence of refractive errors was 108 (27%). Astigmatism was the commonest refractive errors encountered 56 (14%). Seven (1.75%) of the participants were visually impaired, with visual acuity less than 6/18 of the right eye. Our study showed that all types of the refractive errors were relatively more common among males than females. Majority of the participants with refractive errors were in the age group 9-11year old.

Conclusions: Refractive errors are one of the most common prevalent ocular conditions among school children. Implementation of policies including periodical screening of preschool and school children for refractive errors; integration of child eye healthcare into school health programs and further studies of refractive errors among school children in different regions of Sudan are strongly recommended.

Keywords: Refractive errors, myopia, hypermetropia, astigmatism, visual acuity.

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INTRODUCTION

Refractive error or ametropia is a state of refraction in which parallel light rays coming from infinity are focused either in front or behind the retina in one or both the meridians, with accommodation at rest. Ametropia includes myopia, hypermetropia (hyperopia), and astigmatism.^{1,2}

Refractive errors are one of the most common causes of visual impairment during childhood. It is the second leading cause of treatable blindness.³ It is estimated that globally 153 million people over 5 years of age are visually impaired as a result of uncorrected refractive errors, of whom 8 million are blind.⁴ Furthermore, about 12.8 million in the age group 5-15 years are visually impaired from uncorrected or inadequately corrected refractive errors, a global prevalence of 0.96%, with the highest prevalence reported in urban and highly developed urban areas in south-east Asia and in China.⁵ Genetic factors are thought to play a role in development of refractive errors. It has been established that myopia clusters within families, and familial high myopia (refraction of -6 D or less) has been linked to long arm regions on chromosomes 7, 12 and 18.⁶ Environmental factors have also been associated with refractive errors, myopia or hypermetropia. Education and near-work are both strongly associated with increasing severity of myopia.^{7,8} Several studies have been reported prevalence of refractive errors among school children ranged between 6.43% to 40.1%.⁹⁻¹³ Blindness due to refractive errors usually manifests at an early age and the number of blind-person/years due to refractive error in developing countries is approximately twice as high as cataract

related blindness.¹⁴ Personal and socio-cultural factors contribute to an inability to visit eye care professionals leading to diverse consequences.^{15,16} School-age children constitute a particularly vulnerable group, because uncorrected refractive error may have a dramatic impact on learning capability and educational potential. Refractive error is one of the recognized causes of poor performance of school children.^{17,18}

Visual impairment from uncorrected refractive errors can have immediate and long-term consequences in children and adults, such as lost educational and employment opportunities, lost economic gain for individuals, families and societies, and impaired quality of life.¹⁹ A study showed that even in economically advanced societies, refractive errors can go undetected or uncorrected in children.²⁰ Visual impairment due to refractive errors is defined as visual acuity less than 6/18 in the better eye, that could be corrected to 6/18 or better by refraction or pinhole.^{21,22}

The refractive errors and its consequences have been recognized as a public health problem in many countries as well as the World health organization (WHO). The WHO has launched a campaign for managing refractive errors by the year 2020 and placed it as the fifth position for its urgency.^{23,24} A study from Yemen reported that refractive errors were found to be among the most important causes of visual impairment.²⁵ In Sudan, Saleh et al found that the refractive errors was the main cause of visual impairment in children aged 6-15 years;¹² but the prevalence of refractive errors in Sudan still need further studies.

This study aimed to determine the prevalence of refractive errors among primary school children in the age group of 6-15 years in Khartoum city, Sudan.

MATERIALS AND METHODS

This is a descriptive cross-sectional study. It was conducted at Khartoum, Sudan. Eligible participants included pupils of both sexes in the primary schools in Khartoum with age range of 6-15 years. Six government schools were chosen using cluster random sampling technique. A special predesigned form was used to collect personal and socio-demographic data including name, sex, age, history of present and past ocular problems and using of spectacles; and family history of ocular problems and use of spectacles.

In this study the protocol supported by WHO named (The Refractive Error Study in Children, RESC) was followed using consistent definitions and methods; refractive error was defined as an error of $\pm 0.50D$ or more for myopia and hyperopia and a cylindrical error of $\geq 0.50 D$.^{13,26}

School children were first screened at the school premises by the researcher and nurses specially trained for refractive error study. A standard ophthalmic examination procedure was used for each study subject. Ophthalmic examination included assessment of visual acuity for distance with Snellen's illiterate E chart at 6 meters in a well-illuminated room. Children detected with defective vision were referred for further examination at well-equipped ophthalmology clinics in the city. They were further evaluated employing subjective refraction with auto refractometer by experienced optometrists.

The data was analyzed using SPSS program (version 21 USA). Prevalence of visual impairment (visual acuity less than 6/18) was calculated for uncorrected visual acuity, and best measured visual acuity.^{21,22} The percentage, frequency, means and relative mean for data variables were calculated. Chi square test and trend analysis were used to study the association of refractive errors with age, sex and socioeconomic status of pupils.

Ethical consideration

After approval of the study protocol by the ethics committee in Khartoum, permission from Khartoum education directorate was obtained. Written signed consent forms from parents/legal guardians were required as a prerequisite for inclusion. Assents from selected schools were also obtained. The results of child's examination were sent to schools for subsequent management by school health authorities.

RESULTS

This study included a total number of 400 pupils: 284(71%) females and 116 (29%) males. Their age ranged from 6 to 15 years, with median of 10 years. Eighteen (4.5%) of the participants had positive history of wearing glasses, whereas 101(25.25%) had positive family history of wearing glasses. Regarding prevalence of refractive errors among pupils, our results showed that 108 (27%) of the participants had refractive errors. Astigmatism was the commonest refractive errors encountered, 56 (14%); and left eye myopia was the least frequent, 20 (5%). Our study showed that visual acuity of the right eye was less than 6/18 in 7 (1.75%) of the participants. In general, visual acuity was better in the left eye, 359 (89.75%) of them had normal visual acuity of 6/6 compared with 354(88.5%). Visual acuity measurement using binocular vision showed that 376 (94%) of the participants had normal visual acuity; only 3 (0.75%) of them were visually impaired with visual acuity less than 6/18.

Of the total 108 (27%) of the participants with refractive errors, 42 of them were males, representing 36.21% of male participants; while 66 of them were females, representing 23.24% of female participants. All types of the refractive errors were relatively more common among males than females. Our study showed statistically significant relation between the gender and refractive errors ($p=0.004$) (Tables 1 and 2).

Table 1. Distribution of pupils with refractive errors according to gender (Rt eye)

Refractive error rt		Gender		Total
		Male	Female	
Myopia	Count	10	14	24
	% Within RE	41.7%	58.3%	100.0%
	% Within gender	8.6%	4.9%	6.0%
Hyperopic	Count	10	12	22
	% within RE	45.5%	54.5%	100.0%
	% within gender	8.6%	4.2%	5.5%
Astigmatism	Count	17	32	49
	% within RE	34.7%	65.3%	100.0%
	% within gender	14.7%	11.3%	12.2%
Normal	Count	79	226	305
	% within RE	25.9%	74.1%	100.0%
	% within gender	68.1%	79.6%	76.2%
Total	Count	116	284	400
	% within RE	29.0%	71.0%	100.0%
	% within gender	100.0%	100.0%	100.0%

$p=0.013$

Table- 2. Distribution of pupils with refractive errors according to gender (Lt eye)

Refractive Error Lt		Gender		Total
		Male	Female	
Myopia	Count	7	13	20
	% within RE	35.0%	65.0%	100.0%
	% within gender	6.0%	4.6%	5.0%
Hyperopic	Count	18	14	32
	% within RE	56.2%	43.8%	100.0%
	% within gender	15.5%	4.9%	8.0%
Astigmatism	Count	17	39	15
	% within RE	30.4%	69.6%	100.0%
	% within gender	14.7%	13.7%	14.0%
Normal	Count	74	218	292
	% within RE	25.3%	74.7%	100.0%
	% within gender	63.8%	76.8%	73.0%
Total	Count	116	284	400
	% within RE	29.0%	71.0%	100.0%
	% within gender	100.0%	100.0%	100.0%

p =0.004

Majority of the participants with refractive errors were in the age group 9-11year old, 49.47%, and 46.30% in the right and left eyes respectively. Different types of refractive errors were relatively higher in this age group. Our findings showed no statistically significant relation between the age and refractive errors (Table 3).

We found that most of the participants with refractive errors-90 (94.74%) in the right and 104 (96.23%) in the

left eyes- were not wearing glasses before examination for this study. Our findings also showed that only a small portion of the participants with refractive errors-28 (29.47%) in the right and 27 (25%) in the left eyes-reported positive family history of wearing glasses. There was no statistically significant relation between the refractive errors and family history of wearing glasses.

Table-3. Distribution of pupils with refractive errors according to age (Lt eye)

Refractive Error Lt		Age groups				Total
		6-8	9-11	12-14	> 14	
Myopia	Count	4	8	8	0	20
	% within RE	20.0%	40.0%	40.0%	.0%	100.0%
	% within age grs	3.4%	4.4%	8.4%	.0%	5.0%
Hyperopic	Count	6	16	9	1	32
	% within RE	18.8%	50.0%	28.1%	3.1%	100.0%
	% within age grs	5.0%	8.8%	9.5%	20.0%	8.0%
Astigmatism	Count	17	26	13	0	56
	% within RE	30.4%	46.4%	23.2%	0.0%	100.0%
	% within age grs	14.3%	14.4%	13.7%	0.0%	3.8%
Normal	Count	92	131	65	4	292
	% within RE	31.5%	44.9%	22.3%	1.4%	100.0%
	% within age grs	77.3%	72.4%	68.4%	80.0%	73.0%
Total	Count	119	181	95	5	400
	% within RE	29.8%	45.2%	23.8%	1.2%	100.0%
	% within age grs	100.0%	100.0%	100.0%	100.0%	100.0%

p- Value=0.06

DISCUSSION

Refractive error is an important preventable cause of visual impairment and blindness worldwide. Recently reported prevalence of refractive errors in primary school children vary greatly in different regions of the world. The prevalence of refractive errors is changing over time depending on sex, age, and different geographic areas.²² Refractive error is the most common cause of ocular morbidity among school going children.^{17,18}

Regarding prevalence of refractive errors among pupils, our results showed that 27% of the participants had refractive errors. This finding was higher than prevalences reported by Alhadhari, and Abukheir, among primary school children in Tuti Island-Sudan, 12.9%,²⁷ and other regional and international studies from Egypt,⁹ Ethiopia,¹⁰ Saudi Arabia,^{11,28,31} and Pakistan;²⁹ and is slightly less than that reported by other local and international studies from, Sudan,¹² Ghana,³⁰ and Iran⁷. These variations in the prevalence of refractive errors among different studies may be due to differences in sample sizes, definitions of refractive errors, methodology, ethnic, environmental, lifestyle and genetic factors in the study populations. In general, these findings confirm that the refractive errors are one of the most common prevalent ocular conditions occurring in this age group worldwide.

Astigmatism was the commonest refractive errors encountered, 14% of the participants, a finding that was in agreement with other local and regional studies from Sudan^{12,27} and Saudi Arabia,³¹ but in contrast to several regional and international studies;^{9-11,32} myopia was the commonest refractive errors in their studies, but it was the least frequent in our study.

Our study showed that visual acuity of the right eye was less than 6/18 in 1.75% of the participants, but visual acuity measurement using binocular vision showed that only 0.75% of them were visually impaired with visual acuity less than 6/18. Saleh *et al.*, found that 10% of the screened primary school children in Atbara town-Sudan were visually impaired,¹² and another study in Tuti Island-Sudan found that 15% of the screened pupils were visually impaired.²⁷ A study from Cairo-Egypt found that 12.5% of the screened primary school children were visually impaired.⁹ Similar finding, visual impairment in 11.6% of primary school children, was also reported from Ethiopia.³³ A global study estimated that 20% of the study populations were visually impaired due to refractive errors; they reported that the uncorrected refractive errors represents the second cause of blindness after the cataract and the main cause of low vision.²¹ This reflects that refractive errors are one of the important public health concerns that might be responsible of preventable blindness.

Our study showed that all types of the refractive errors were relatively more common among males than females, with statistically significant relation between the male gender and refractive errors, ($p = 0.004$). This finding was in agreement with a study from Nepal,^{13,18} and India³⁴. But it is in contrast to other studies from Sudan,²⁷ and several other regional and international studies from Saudi Arabia,^{11,31,32} Egypt,⁹ Ethiopia,¹⁰ and Thailand²². They reported preponderance of refractive errors among females more than males. One may say from these contradictions that gender by itself has no significant precipitative or causative effect for refractive errors, but other factors such as habitual, stress, intensive near work, environmental, ethnic and genetic factors seem to be more important.^{7,35}

Majority of the participants with refractive errors were in the age group 9-11year old, 49.47%, and 46.30% in the right and left eyes respectively. Different types of refractive errors were relatively higher in this age group. This is approximately similar to that found by other studies.^{10,31,35} However, another study from Nepal found that refractive error prevalence was higher in older school children.¹³ This may be explained by the complex pattern of human refractive development suggesting that the emmetropia is not the preferred endpoint for refractive development.³⁶

We found that most of the participants with refractive errors-94.74% in the right and 96.23% in the left eyes-were not wearing glasses before examination for this study. This reflects the general unawareness of risk factors and defective capability to detect refractive errors at the community level. Our findings also showed that only a small portion of the participants with refractive errors - 29.47% in the right and 25% in the left eyes - reported positive family history of wearing glasses. There was no statistically significant relation between the refractive errors and family history of wearing glasses. This is in contrast to other studies reported significant relation between the refractive errors and family history of refractive errors.^{28,37}

In conclusion, this study confirms that the refractive errors are one of the most common prevalent ocular conditions occurring in this age group worldwide. Astigmatism was the commonest refractive errors encountered (14%). Our results showed that all types of the refractive errors were relatively more common among males than females, with statistically significant relation between the male gender and refractive errors. Majority of the participants with refractive errors were in the age group 9-11year old. Different types of refractive errors were relatively higher in this age group.

We recommend implementation of fundamental policies including periodical screening of preschool and school children for refractive errors; integration of child eye health-care into school health programs; providing supported low-cost spectacles for school children to encourage spectacle use when it is prescribed; and health education and awareness campaigns for school children, teachers and general community; as well as further studies of refractive errors among school children in different regions of Sudan including rural areas.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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