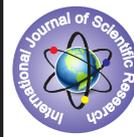


Prevalence of Uncorrected Refractive Errors Among Pre-school Children in Madinah City, Saudi Arabia: A pre-school based cross-sectional study



Medicine

KEYWORDS: Pre-school children, Kindergarten, Prevalence, Refractive errors, Saudi Arabia

Abdulrahman Hamzah Badawi	MD, King Khaled Eye Specialist Hospital, Riyadh, Saudi Arabia
Abdulrahman Faisal AlBloushi	MD, King AbdulAziz University Hospital, King Saud University, Riyadh, Saudi Arabia
Mohammed M. Rashwan	College Of Medicine, Taibah University, Madinah, Saudi Arabia
Ahmed O. Alsebae	College Of Medicine, Taibah University, Madinah, Saudi Arabia
Abdulrhman A. Ghunaim	College Of Medicine, Taibah University, Madinah, Saudi Arabia
Abdulrahman O. yousef	College Of Medicine, Taibah University, Madinah, Saudi Arabia

ABSTRACT

Background and objectives: Refractive errors (RE) is one of the most common causes of vision impairment among children, but little is known about its prevalence among pre-school children in certain Saudi regions, including Madinah city. This study aimed to measure the prevalence of uncorrected RE among pre-school children attending kindergartens in Madinah city, Saudi Arabia.

Methods: A pre-school -based cross-sectional study was carried out in Madinah city during the study year 2016/2017. A cluster random sample was taken and included 800 pre-school children (3-6 years) from 12 Kindergartens. The studied pre-school children were screened to diagnose uncorrected RE using auto-refractometer. The prevalence of different types of uncorrected RE were estimated among the studied children. Appropriate statistical analyses, including logistic regression analyses were performed.

Results: The response rate was 94% (750 out of 800). The prevalence of uncorrected RE in the studied 750 children was (8%; 95% CI= 6.1%-9.9%) with significant differences by age group. The prevalence was 3.6% for myopia, 3.3% for astigmatism, and 1.1% for hypermetropia. Risks for uncorrected RE among studied pre-school children were positively associated with age and this was marked in myopia and astigmatism. Myopia was associated more with girls, while hypermetropia was associated more with boys.

Conclusions: The prevalence of uncorrected RE was high among pre-school children aged 3-6 years attending kindergartens in Madinah city. Establishment of vision screening programs for pre-school children attending kindergartens in Madinah is crucial to reduce the undesirable future effects of uncorrected RE among them.

Introduction

Refractive error is one of the most common causes of visual impairment. It is one of the most common childhood problems and the second leading cause of treatable blindness (1). In 2010, the World Health Organization declared the Vision 2020 action plan that included refractive error as a priority in the prevention of childhood blindness (2). It has been reported that the prevalence of myopia is more than 70% in young children (3). Significant refractive errors left uncorrected in younger children places them at risk for amblyopia (4) and strabismus (5). This trend alone supports the need for vision screening and early detection of amblyopia and strabismus among preschool children. Although many studies have addressed the refractive error of school-aged children (6-9), few population-based studies have been performed focusing on the refractive error among preschool children in worldwide (10). The recent studies in Saudi Arabia have stressed on the prevalence of refractive errors among school aged children (11), and adolescents (12) and more recently a study included school entrant submitted to obligatory medical examination in School health center at King Abdulaziz Medical City (KAMC) Riyadh, Saudi Arabia (13).

Although the Scandinavian experience (14) and other data (15) showing the effectiveness of pre-school screening in reducing visual morbidity from amblyopia, the Saudi school health services provided by ministry of education, does not yet include adequate vision screening facilities at kindergartens (16). The present cross-sectional study is first study conducted in Madinah city, Saudi Arabia aimed to assess the prevalence of uncorrected RE among pre-school children

attending kindergartens.

Methods

Study setting and population

The present kindergarten-based cross sectional study was conducted among pre-school children (3-6) in Madinah city, Saudi Arabia to determine the prevalence of uncorrected refractive error among them. Madinah city is the second holiest city in the Hejaz region of western Saudi Arabia, and the capital of Al Madinah Province. The Saudi population of Madinah city was 784,722 according to 2010 Census (17). The basic educational system in Saudi Arabia is divided into primary, intermediate and secondary. Primary education lasts six years, and children at the age of 6 enter the first grade of primary education. Nursery schools and kindergartens were also frequent all over Madinah city and accept children from 3 to 6 years old (18). In this study, all children attending kindergartens in Madinah city were eligible to participate in this study.

Sampling technique and size

A cluster multistage, stratified random sampling procedure was conducted. Madinah city is divided into 12 districts. From each district one kindergarten was chosen randomly. Within each selected kindergarten, all children without corrected refractive error were eligible and invited to participate in the study. Children below 4 years or above 6 years and disabled children were excluded. The primary calculated sample of this study is 720 pre-school children based on the recent reported prevalence of RE among school entrants (4.5%) in Riyadh, Saudi Arabia (13), an assumed precision of 0.05 and

confidence interval of 95%. Accounting for non-response, the sample size increases to 800 children.

The study was conducted during the first half of the study year 2016/17 from October to December in 2016. The children submitted to vision screening in their respective kindergartens. Visual acuity (VA), cover and uncover test and cycloplegic streak retinoscopy were performed using a standardized testing environment. Cover and uncover testing was conducted to determine strabismus at a 33-cm distance before cycloplegia. VA was tested with Snellen's chart and best-corrected visual acuity (BCVA) would be measured if the VA was less than 0.5. The participants were administered topical tropicamide phenylephrine (Santen Pharmaceutical Co., Ltd) eye drops 3 times, with 10 min between each dose. Cycloplegic refraction was determined by streak retinoscopy 30 min after the last drop to ensure maximal cycloplegic effect.

Definition of refractive error (19)

The refractive error was taken as the spherical equivalent (SE) in diopters (D) and calculated as the power of the sphere plus half the cylindrical power. Eyes with a SE from -0.75 to +1.75 D were classified as emmetropic. Myopia was defined as SE refractive error of at least -0.75 D and hyperopia as +1.75 D or more. Astigmatism was defined as the cylinder power of 1.00 D or more and was classified into three categories: with-the-rule (WTR) astigmatism (cylinder axes between 1° and 15° or 165° and 180°), against-the-rule (ATR) astigmatism (cylinder axes between 75° and 105°), and oblique astigmatism (cylinder axes between 16° and 74° or 106° and 164°). Significant visual abnormalities included: visual acuity of < 0.5, manifested strabismus, myopia (SE ≤ -1.00 D), hyperopia (SE ≥ +2.00 D), astigmatism (cylinder ≥ 1.00 D), nystagmus, and cataract.

The collected data were entered and analyzed using SPSS version 20.0. (SPSS Inc. Chicago, IL, USA). Data were presented using frequencies, means and standard deviation (SD). The presence of uncorrected refractive errors according to vision screening among the studied children were assessed, analyzed and compared by the children age and sex using appropriate statistical tests. P values ≤ 0.05 were used as indicators of statistical significance differences between the studied groups. Logistic regression analyses were also used to estimate the risk of diagnosed refractive errors (total and by their sub-types) among the studied children by their age and sex.

Participation in the study was voluntary and the kindergarten officials were clearly informed about the aim and scope of the study. At the time of data collection, the researcher read out the consent form to obtain informed consent of the studied child parents. Data privacy and confidentiality was ensured for all collected data and was used only for the research purposes. Finally, Children who required management were referred to the nearest health care facility in cooperation with the kindergarten doctor.

Results

The present study has screened 800 pre-school children. Of them 50 (6.3%) were excluded where 15 children were excluded because their parents refused to do screening for them, 27 were already wearing glasses and for 8 children we couldn't examine them either they didn't understand or couldn't stay calm for the auto-refractometer. Finally, the study has screened and analyzed 750 children aged from 3 to 6 years to assess the frequency and types of uncorrected refractive errors (RE) among them. The sample included 382 boys (51%) and 368 girls (49%), and the mean age of studied children was 4.9 ± 0.9 years.

Table 1 presented the distribution of the screened children according to the results of vision screening by their age groups and sex. Among the screened children, 60 children (8%; 95% CI= 6.1%-9.9%) were diagnosed to have uncorrected RE. The proportion of children with uncorrected RE was significantly higher among children aged 3-<5 years (n= 40 (9.3%)) and those aged 5-6 years (n= 20 (6.2)). On the

other hand, no significant difference was observed between boys and girls and the proportion of uncorrected RE was comparable among them (8.6% among boys and 7.3% among girls).

Table 2 presented the association of uncorrected RE by age and sex distribution of the screened children. The logistic regression analysis showed the risk of uncorrected RE was less among children aged 5-6 years. The risk of RE was among those children 0.65 (95% CI= 0.12-1.23) compared to those aged less than 5 years. There was no association, however, between RE and sex of the screened children.

Table 3 showed the distribution and association of hypermetropia by age and sex of the studied children. The hypermetropia was presented in 1.1% of the studied children (8 out of the screened 750 children), and its distribution did not show significant variation by age groups, although the risk was less by 20% among children aged 5-6 years. Among boys, however, there was significant difference between the prevalence among them (1.6%) and the studied girls (0.6%), with a significant increased risk among boys (OR=2.90; 95% CI= 1.20-8.50)

Table 4 presented the distribution and association of astigmatism by age and sex of the screened children. Astigmatism was diagnosed in 25 children (3.3%) of the screened sample including cases of myopic astigmatism (n= 6 (24% of all astigmatism cases)). The prevalence of astigmatism showed significant variation by the studied age groups and sex where it was more in the age group 5-6 years (5.4%), and its risk was significantly increased among this age groups (OR=2.90; 95% CI= 1.10-7.10). The prevalence of astigmatism was almost similar among boys (3.2%) and girls (3.5%) with no association detected between sex of the studied children and astigmatism.

Table 5 displayed the association of age and sex of the studied children. The prevalence of Myopia was 3.6% of the studied children (27 out of 750). However, its prevalence was higher among children aged 5-6 years (2.1%) and among girls (2%). The risk of myopia was increased by 2.0 and 1.3 among those children aged 5-6 years and girls, respectively.

Discussion

In this study, the prevalence of uncorrected refractive error (RE) among pre-school children aged 3-6 years in Madinah city, Saudi Arabia was 8% (95% CI= 6.1%-9.9%). The prevalence of uncorrected RE was significantly higher among children aged 3-<5 years (n= 40 (9.3%)) and those aged 5-6 years (n= 20 (6.2)). These prevalence values have been appeared to be lower than what was reported in other similar Saudi studies. Of these studies, two studies carried out in Abha (20), and Jeddah cities (21) among children at the age of school entry (6 and more years), showed a prevalence of 23% and 10.7%; respectively. Another study done in Al Hassa region on primary school children revealed the prevalence of RE of 13.7% (11). In a recent study included school entrants, of 6 and more years old, submitted to obligatory medical examination in School health center at King Abdulaziz Medical City (KAMC) Riyadh, Saudi Arabia, they reported prevalence of 4.5% among the studied children (13). This prevalence was comparable with that reported in our study regarding the older children 5-6 years where the prevalence of RE among these children was 6.2%. In comparison to other countries, the prevalence of uncorrected RE in this study was much lower than what reported among children of similar age group, where the prevalence of 17.5% in Egypt (22), 15.2% in Qatar (23), 17.2 in Malaysia (24), and 13.1% in India (25). This observed variation might be attributed to the variations in the operational definition and cut off points of refractive errors used in this and other mentioned studies. In addition, while in our study kindergarten children were only included, the other studies have included older children and adolescent which are likely more exposed to television viewing, excessive internet use and poor lifestyle habits affecting low vision (26). The proportions of children wearing glasses were higher among those watching internet/television for more than three hours a day

(27). In a recent Saudi study, Ghamdi (28) has reported a significant difference between students with and without REs according to daily hours of using computer and TV.

This study did not only focus on the magnitude of uncorrected refractive error by age and sex of the studied children, but it also has focused on the role of these variables as risk factors of different types of RE diagnosed in the studied children.

In the present study, the prevalence of hypermetropia was 1.1% of the whole studied children, and its distribution did not show significant variation by age groups, although its risk was reduced among children aged 5-6 years. The prevalence among boys (1.6%) was significantly higher than among girls (0.6%), with a significant increased risk among boys (OR=2.90; 95% CI= 1.20-8.50). In a study conducted in Riyadh city, the prevalence of hypermetropia was 2.1% among the studied 1319 children (13). Similar prevalence was also reported in different countries as it was 1.8% a South African (29), and 2.1% prevalence in Iran (30).

Astigmatism showed a high prevalence of RE in this study. It was 3.3% of the screened sample and showed significant variation by the studied age groups and sex where it was more in the age group 5-6 years (5.4%), and its risk was significantly increased among this age group. The prevalence of astigmatism, was similar among the studied boys (3.5%) and girls (3.2%). This observed prevalence was slightly higher than those reported in similar Saudi studies (13), which was 2.5%.

The prevalence of myopia showed the higher prevalence (3.6%) of RE among the screened children in this study. However, its prevalence was higher among children aged 5-6 years (2.1%) and among girls (2%). The risk of myopia was increased by 2.0 and 1.3 among those children aged 5-6 years and girls, respectively. A higher prevalence was reported in a recent Saudi study (31), conducted in 21 primary school children with their mean age of 9.5 ± 1.8 years in Qassim province, where the prevalence was 5.8%. However, the study has reported similar results to that in our study as the prevalence of myopia was significantly higher in girls compared to boys and the risk was increased by 1.5 among the studied girls.

The consequences of uncorrected RE among children are discussed in several studies. The presence of uncorrected RE among school children is known to affect scholastic achievement and class performance among these children. In a study done in primary school children in Brazil reported that children with low vision had a 10% higher probability of dropping out of school and 18% higher probability of repeating a grade (32).

The present study appeared to have a number of strengths, include being a kindergarten-based study with high response rate (94%), which consolidates the study findings. To the best of our knowledge, this study is the first to examine the magnitude of uncorrected RE in very young children (3-6 years) in Madinah city, Saudi Arabia. Finally, the association of RE with age groups and sex was examined for different types of RE.

In summary, the prevalence of uncorrected RE among kindergarten children in Madinah city, Saudi Arabia is relatively high, particularly myopia, with significant variations by age and sex. These findings reflect the need to design an appropriate and effective vision screening program for children attending Kindergartens in Madinah city for an effective and sustainable early detection of pre-school children with uncorrected RE. This suggested program may be integrated within school health programs for instance.

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Tables of the study:

Table 1. Distribution of the studied pre-school children by their age and sex and the results of vision screening

	No. Screened	No. Uncorrected Refractive Error*	P. value
Sex			
Girls	368	27 (7.3)	0.18
Boys	382	33 (8.6)	
Age in years			0.03**
3- < 5 years	430	40 (9.3)	
5-6 years	320	20 (6.2)	
Total	750	60 (8.0)	

*Data are presented in n (%)

**Significant

Table 2. Association of uncorrected refractive error as result of screening with age and sex of the studied children

	Refractive errors*		OR	95% CI
	Yes n= 60	No n= 690		
Sex				
Girls	27 (7.3)	341 (92.7)	1.00	Ref. 0.90-3.80
Boys	33(8.6)	349 (91.4)	1.20	
Age in years				Ref. 0.12-1.23
3- < 5 years	40 (9.3)	390 (90.7)	1.00	
5-6 years	20 (6.2)	300 (93.7)	0.65	

*Data are presented in n (%)

**Significant

Table 3. Association of hypermetropia with age and sex of the studied children

	Hypermetropia*		P Value	OR	95% CI
	Yes n= 8	No n= 742			
Age in years			0.75	1.00 0.80	Ref. 0.34-2.15
3- < 5 years	5 (1.2)	425 (98.8)			
5-6 years	3 (0.9)	317 (99.1)			
Sex			0.01**	1.00 2.90	Ref. 1.20- 8.50**
Girls	2 (0.6)	366 (99.4)			
Boys	6 (1.6)	376 (98.4)			

*Data are presented in n (%)

**Significant

Table 4. Association of astigmatism with age and sex of the studied children

	Astigmatism*		P value	OR	95% CI
	Yes n= 25	No n= 725			
Age in years			<.0001**	1.00 2.90	Ref. 1.10- 7.10**
3- < 5 years	8 (1.9)	422 (98.1)			
5-6 years	17 (5.4)	303 (94.6)			
Sex			0.86	1.00 1.05	Ref. 0.85-1.35
Girls	12 (3.2)	356 (96.7)			
Boys	13 (3.5)	369 (96.5)			

*Data are presented in n (%).

**Significant

Table 5. Association of myopia with age and sex of the studied children

	Myopia*		P value	OR	95% CI
	Yes n= 27	No n= 723			
Age in years			0.04**	1.00 2.00	Ref. 1.10-8.15
3- < 5 years	11 (1.4)	419 (98.6)			
5-6 years	16 (2.1)	304 (97.9)			

Sex					
Girls	15 (2.0)	353 (98.0)	0.18	1.30	0.80-4.90
Boys	12 (1.6)	369 (98.4)		1.00	Ref.

*Data are presented in n (%)

**Significant

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