CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES
http://doi.org/10.5281/zenodo.3861951

Available online at: http://www.iajps.com Research Article

INFLUENCE OF SEVERAL FACTORS ON REFRACTIVE ERRORS CORRECTION AMONG PRIMARY SCHOOL CHILDREN IN SAUDI ARABIA

Rashed Raja Alshammari *[1], Sulaiman Saud Alsamaan [2], Turki Saad Aljuhani [3], Abdullah Saud Alshammari [4], Hamoud Hussein Al-Sunitan [5], Dr. Abrar Wazzan [6]

*[1-5] University of Hail, Faculty of Medicine, Saudi Arabia.

[6] Consultant, Faculty of Medicine, Saudi Arabia.

Abstract:

The aim of this study is to determine the prevalence of uncorrected refractive errors (URE) among children 3-10 years of age and to confirm the need for a national school-based visual screening program for school-aged children. Due to quarantine in Saudi Arabia due to the spread of Coronavirus, this study is dependent on previous studies, and the researcher analyzes the results of previous studies related to the subject so that the researcher uses the inductive approach with the use of citations for all sources. The main study discussed was a retrospective cross-sectional study conducted in Medina, Saudi Arabia in 2015. Children were selected through multi-stage stratified random sampling from 8 kindergartens and 8 primary schools. Those included were screened to diagnose UREs using a visual acuity chart and an auto-refractometer as per American guidelines. Prevalence and types of UREs have been estimated. The results of this study are based on the results of (Alrahili et al., 2017) which found that 1893 of the 2121 children listed had been examined, yielding a response rate of 89.3 per cent. The prevalence of URE was 34.9 per cent (95 per cent CI = 32.8 per cent-37.1 per cent), with significant differences in different age groups. The prevalence of astigmatism (25.3 per cent) was higher than that of anisometropia (7.4 per cent), hypermetropia (1.5 per cent) and myopia (0.7 per cent). The risk of incorrect refractive error was positively associated with age, and this was mentioned in astigmatism, myopia, and anisometropia. In addition, the risk of hypermetropy was associated with boys and the risk of myopia was associated with girls. To conclude, the prevalence of URE, in particular astigmatism, was high among children 3-10 years of age in Medina, with significant age differences. Vision screening programs targeting kindergartens and primary school children are crucial in reducing the risk of the preventable visual impairment according to URE.

Key words: *Refractive Error, School Children, Astigmatism.*

Corresponding author:

Dr Rashed Raja Alshammari,

University of Hail, Faculty of Medicine, Saudi Arabia

QR code

Please cite this article in press Rashed Raja Alshammari et al, ***Influence Of Several Factors On Refractive Errors Correction Among Primary School Children In Saudi Arabia,*** *Indo Am. J. P. Sci, 2020; 07(05).*

INTRODUCTION:

Refractive errors (RE) such as myopia, hypermetropia, and astigmatism are commonly seen eye disorders. They are caused by an inconsistency between the axial length and the refractive power of the optical elements of the eye. (Wensor et al., 1999) Visual problems due to incorrect refractive errors (URE) in school-aged children have a profound influence on their educational, social and general quality of life (Karande & Kulkarni, 2005), (Tabbara et al., 2005)

There are several factors that may influence the lack of RE correction among children. These factors include lack of awareness of the problems faced by the child, the family, the community or the public health authority; the inability to provide refractive services; inadequate provision of affordable corrective lenses; and poor compliance with the wearing of spectacles. (Resnikoff and others, 2004) Detecting these errors in any age group older than 10 years may be useless because the patient has probably developed an incurable preventable amblyopia that leads to blindness. Although annual vision screening is an important strategy for prevention of visual impairment, school health services in Medina do not provide early visual health care programs.(Newman et al., 1996) It was therefore necessary to carry out a study identifying the proportion of children who are aged 3-10 years with URE who may be susceptible to developing permanent preventable complications such as amblyopy.

The goals of this study are to determine the prevalence of URE among school children in Medina, Saudi Arabia, and whether or not there is a government-funded visual screening service for school-aged children.

METHODS:

The main study discussed was a retrospective cross-sectional study conducted in Medina, Saudi Arabia in 2015. This cross-sectional retrospective study was conducted in the kindergarten and elementary school children of Medina from April to August 2015. A random selection of geographically defined clusters was used to identify a representative sample of children aged 3 to 10 years. Eight kindergartens and four primary schools of each gender were chosen in order to represent these clusters, with an average of 130 children in each and a total of 2121 children. Children whose parents didn't consent to the examination of their children or children who did not cooperate during the test were excluded. Children who did not understand their role in the screening process, or those already wearing contact lenses or glasses that compensated for their RE to 6/6, were also excluded. Towards the end of the academic year 2014-2015, the research team organized visits to known schools and kindergartens to examine children aged 3-10 years.

The eye examination consisted of two sections:
1) Visual acuities were measured by 2 ophthalmologists by using the Snellen tumbling E-chart. This chart was placed on a wall 6 meters away from the child being examined. Each eye was measured separately, starting with the child's right eye while covering the left eye; then the same procedure was repeated for the left eye covering the right eye.

Children tested were instructed to use either hand (with fingers extended) to show which direction the "fingers" of the E pointed: right, left, up, or down. The examiners registered the smallest line that the child had correctly read more than half of the letters. The visual acuity test was used only to clarify the results of the auto-refractometer and was excluded from the statistical analysis of the study. The results of the visual acuity test supported the results of the auto-refractometer in all the cases examined as children with RE were found to have poor visual acuity for their age: I Children 3-5 years of age who did not correctly identify the majority of optotypes on line 20/40.6 (ii) Children 5-10 years of age who could not read the majority of optotypes on line 20/32 either.

2) Refractive errors were measured using a handheld auto-refractometer. This device is a fully automated handheld binocular refractometer and vision analyzer that achieves non-cycloplegic self-refraction and measures both eyes at a stable distance of one meter at the same time. It also measures the direction of the gaze, the alignment of the eye, the diameter of the pupil, the distance between the pupil and the accommodative balance or imbalance between the two eyes in an all-in-one process. Measurements were made in a uniform, dimly lit environment as the accuracy of the measurements was affected by external light sources.

The children had to keep their eyes wide open and look at the center of the camera, which was held horizontally by the examiner at the same height of the child's eyes at a distance of one metre. In addition, the examiners turned on the vision-fixing targets as these lights attracted the attention of the child and ensured that they looked at the center of the camera. During the measurement, both eyes had to appear inside the alignment window, as the line connecting the pupils should be horizontal to the apparent window.

The examiner then pressed and held the start button to enter the focus phase, adjusting the distance to the corneal reflexes until the image came into focus. If

there were squares or purple rings around the pupil, the distance was not right, and the examiner moved slightly closer or further away from the child to find the best focus until two green circles appeared around the child's pupil linked by a horizontal line. The examiner then released the start button and the auto-refractometer automatically displayed the measurements on the screen in approximately 2 seconds.

The upper part of the screen showed the sphere, the cylinder and the axis of both eyes as well as a reliability index (this should be higher than 5; if it was 5 or less, the tester repeated the measurement) indicating the reliability of the measurement. Also, it measured the distance and size of the pupil and the alignment of the eyes. The results were printed on a portable printer and the report was stored on the device and uploaded to the examiner 's computer.
In this study, the RE cut-off points were defined on the basis of the American guidelines for spectacle-prescribing by the American Association for Pediatric Ophthalmology and Strabismus (AAPOS) as follows:7 1) Hypermetropy was ≥+3 Diopters in children of all ages. 2) Myopia was ≥-3 Diopters in children aged 3-6 years, ≥-1 Diopters in children aged 6 years and older. 3) Astigmatism was > 2 Diopter in children aged 3-6 years and > 1 Diopter in children aged 6-10 years. 4) The difference in anisometropia was ≥1.00 Diopter. 5) The-rule (WTR), anti-rule (ATR) and oblique types of astigmatism have been determined to determine the overall prevalence of astigmatism. The objective of this study is not to compare the prevalence of different variations in astigmatism.

The referral criteria included children with URE according to the different RE definitions used in this study. Printed reports and a list of children who meet the referral criteria have been provided to school health guides who have been asked to refer them to primary health care units for proper intervention.
No ophthalmoscopy was performed to detect ocular pathology during the study. A pilot study involving 20 children not included in the primary study was conducted to evaluate feasibility, time and logistical operations. In addition , in order to prevent inter-observer variation in the assessment, all the examiners used the same visual acuity chart at the same distance and the same handheld self-refractometer and carried out the previous procedures under the supervision of one of the authors who is a qualified ophthalmology consultant. Academic search engines such as PubMed and Google Scholar have been used to find and access scientific literature related to our study.

The presence of vision-based URE among the children studied was evaluated, analyzed and compared with the age and gender of the children using the chi-squared test. For myopia, the exact Fischer test was used to compare the distribution of this refractive error among the children studied by their age groups (Table 1), as the number of children was less than 5 in more than 25 percent of the table cells. P-value ≤0.05 was considered statistically significant. Logistic regression analyzes were also used to estimate the risk of a diagnosis of RE (total and by type) among the children studied by age and gender.

RESULTS:

The present study examined 2121 children. Of these, 228 (10.7 per cent) were exempted (200 were exempted because their parents did not consent, 25 were already wearing glasses, and 3 were uncooperative during testing). 1893 children aged 3-10 years were screened and analyzed to determine the frequency and types of URE among them. The sample included 947 boys (50.3 per cent) and 946 girls (49.7 per cent) and the mean age of the children studied was 6.2 ± 1.9 years.

Table 1 reveals the distribution and association of different types of URE by age and gender of the children tested. Hypermetropy was present in 1.5 per cent of children (29 out of 1893) and astigmatism was present in 25.3 per cent (479 out of 1893), including cases of myopic astigmatism; n = 13 (2.7 per cent of all cases of astigmatism). Myopia had the lowest prevalence in only 0.7% of children (13 out of 1893), and 140 had anisometropia (7.4%).

Table 2 shows the distribution of the children screened by their age groups and gender according to the results of the screening. Among the children tested, those with URE (34.9 per cent; 95 per cent CI = 32.8 per cent-37.1 per cent) were found to have poor visual acuity due to age. Children with good visual acuity for their age, on the other hand, did not show any RE during the examination.

Table 3 shows the association between the age of the URE and the gender distribution of the children screened.

Table 1 - Association of different types of uncorrected refractive errors (URE) with age and gender of the studied children.

Types of URE	Age (years)			Gender	
	3 - <6	6 - <8	8 - 10	Girls	Boys
Hypermetropia (%)					
Yes (n=29)	12 (1.4)	4 (1.0)	13 (2.0)	7 (0.7)	22 (2.3)
No (n=1864)	853 (98.6)	379 (98.9)	632 (98.0)	939 (99.3)	925 (97.7)
OR	1.00	0.75	1.50	1.00	3.20
95% CI	Ref.	0.24-2.35	0.70-3.20	Ref.	1.40-7.50*
P-value		0.42		0.01*	
Astigmatism (%)					
Yes* (n=479)	118 (13.6)	161 (42.0)	200 (31.0)	241 (25.5)	238 (25.1)
No (n=1414)	747 (86.4)	222 (58.0)	445 (69.0)	705 (74.5)	709 (74.9)
OR	1.00	4.60	2.90	1.00	0.98
95% CI	Ref.	3.50-6.10*	2.20-3.70*	Ref.	0.80-1.20
P value		<0.0001‡		0.86	
Myopia (%)					
Yes (n=13)	2 (0.3)	3 (0.7)	8 (1.3)	8 (0.9)	5 (0.5)
No (n=1880)	863 (99.7)	380 (99.3)	637 (98.7)	938 (99.1)	942 (99.5)
OR	1.00	3.40	5.40	1.60	1.00
95% CI	Ref.	0.60.20.5	1.20-25.0*	0.50-4.50	Ref.
P value		0.06		0.40	
Anisometropia *(%)*					
Yes (n=140)	50 (5.7)	37 (9.7)	53 (8.2)	73 (7.7)	67 (7.1)
No (n=1753)	815 (94.3)	346 (90.3)	592 (91.8)	873 (92.3)	880 (92.9)
OR	1.00	1.75	1.50	1.00	1.10
95% CI	Ref.	1.10-2.70*	1.01-2.17*	Ref.	0.78-1.55
P-value		0.03*		0.59	

*Significant, OR - odds ratio, 95%CI - 95% confidence intervals

Table 2 - Distribution of the studied children according to the results of vision screening by their age groups and gender.

Variables	Number screened	Number UREs (%)	*P*-value
Age (years)			
3 - <6	865	182 (21.0)	
6 - <8	383	205 (53.5)	
8 - 10	645	274 (42.5)	<0.0001*
Gender			
Girls	946	329 (34.7)	
Boys	947	332 (35.0)	0.98
Total	1893	661 (34.9)	

*Significant, URE - uncorrected refractive errors

Table 3 - Association of uncorrected refractive errors (URE) as result of screening with age and gender of the studied children.

Variables	URE		Odds ratio (95% CI)
	Yes (n=661)	No (n=1232)	
Age (years)			
3 - <6	182	683	1.00 (Ref.)
6 - <8	205	178	4.30 (3.10-5.80)*
8 - 10	274	371	2.80 (2.20-3.90)*
P-value		<0.0001*	
Gender			
Girls	329	617	1.00 (Ref.)
Boys	332	615	1.03 (0.82-1.22)
P-value		0.90	

*Significant, 95% CI - 95% confidence intervals

DISCUSSION:

The presence of URE among schoolchildren is known to have an impact on scholastic achievement and the class performances. (Ovenseri et al., 2010), (Gomes-neto et al., 1997) as per our study, the prevalence of URE among children 3-10 years of age in Medina was 34.9% (95 percent CI = 32.8%-37.1%). This prevalence was significantly higher in children aged 6 to > 8 years (53.5 per cent) and children aged 8 to 10 years (42.5 per cent). Also, the URE detected did not vary by eye, and there was no aphakia in the study group. These prevalence values appear to be much higher than the prevalence values reported in other similar Saudi studies (Table 4). The prevalence of URE in this study was much higher compared to other countries (Table 5). This observed variation from the results of the studies mentioned above (even in studies conducted in the same country) could be attributed to differences in the operational definition and the RE cut-off points. Another possible cause of this difference may be environmental influences. Better socio-economic conditions in Saudi Arabia, which affect lifestyles such as television viewing, overuse of the Internet, and poor lifestyle habits, have a negative impact on schoolchildren's low vision. (2010) (Bener et al.)

Table 4 - The reported prevalence of uncorrected refractive errors (URE) in other similar Saudi studies with the number and age of the studied children.

Country	Sample size	Studied age group (years)	Prevalence of refractive errors (%)
Saudi Arabia (Abha)[25]	975 children (boys only)	6 - 12	23.0
Saudi Arabia (Jeddah)[26]	102 children of both genders	Kindergartens	10.7
Saudi Arabia (Al-Hasa region)[27]	2246 children of both genders	6 - 14	13.7
Saudi Arabia (Riyadh)[28]	1319 children of both genders	4 - 8	4.5

Table 5 - The reported prevalence of uncorrected refractive errors (URE) in other similar foreign studies with the number and age of the examined children.

Country	Sample size (children of both genders)	Studied age group (years)	Prevalence of refractive errors (%)
Egypt[29]	1292	7-15	17.5
Qatar[30]	670	Primary schoolchildren (grades 1 to 6)	15.2
Malaysia[31]	4634	7 -15	17.1
Chile[32]	6998	5 -15	15.8
India[33]	18500	5 -15	13.1

A Qatari study of children ranging in age 6 to 18 years found that a majority of children wearing glasses was higher among those using the Internet / television for even more than 3 hours a day. (Bener et al., in 2012)

A recent Saudi study (Al-Ghamdi, 2013) documented a significant difference between students with and without RE in terms of daily computer and TV hours. In addition, the sample in this study was collected from Medina, which represents a well-urbanized community in the western region of Saudi Arabia.

Results from previous studies (Murthy et al., 2002) (Dandona et al., 2002) documented that the prevalence of RE among urban children was higher than among rural children. In this study, we focused not only on the magnitude of URE by age and gender, but also on the role of these variables as the risk factors for different types of RE. The prevalence of hypermetropia was 1.5 per cent and the distribution of hypermetropia showed insignificant variation in age groups, although the risk increased 1.5 times among children aged 8 to 10 years. The prevalence in boys (2.3 per cent) was significantly higher than in girls (0.7 per cent), with a significantly higher risk among males (OR = 3.20; 95 per cent CI = 1.40-7.50). A study in Riyadh revealed that the prevalence of hypermetropy was 2.1% among 1,319 children. (Al-Rowaily, 2010) Similar prevalence figures have also been reported in different countries, such as 1.8 per cent in South Africa (Fotouhi et al., 2007) and 2.1 per cent in Iran.18 Astigmatism, the predominant form of URE in the present study, was analyzed as with-the-rule (WTR: 90±30 °), against-the-rule (ATR: steepest meridian 180±30 °) and oblique (OB: 30-60 ° or 120-150 °). Astigmatism revealed a total prevalence of 25.3 per cent with significant age and gender variations and significantly increased risk among older age groups. A study measuring the relationship between the age and the astigmatism revealed that ATR astigmatism was directly proportional to age. (Murthy et al., 2002) However, the prevalence of astigmatism among boys was similar, and there was no association between gender and astigmatism. This observed prevalence was much higher than those reported in Saudi20 and other countries. (Aldebasi, 2014), (Czepita et al., 2007), (Yekta et al., 2010) However, the prevalence and risk of astigmatism increased with increasing age in the previous Saudi study (Aldebasi, 2014). The prevalence of myopia was 0.7 per cent and was higher in children 8-10 years of age (1.3%) and in girls (0.9%). Risk of myopia increased by 3.4 and 5.4 in children ranging in age from 6 to > 8 years and 8 to 10 years respectively.

A much higher prevalence was documented in a recent Saudi study (Aldebasi, 2014) in the province of Qassim, where the prevalence was 5.8 per cent. However, the study documented similar results to our study, as the prevalence of myopia was significantly higher in girls compared to the boys and the risk increased by 1.52 in girls studied. Per an article published by the American Academy of Ophthalmology, myopia has increased prevalence in

girls around the age of 9 years and continues to adolescence.

This pattern of gender difference highly suggests a hormonal role in the development of myopia. (Holden et al., 2016) The discovery of a high prevalence of anisometropia in our study confirms various studies of anisometropia. The prevalence of this refractive error revealed statistically significant differences in the age groups studied, with the highest prevalence among children ranging in age between 6 to > 8 years (9.7%), with the risk increasing by 1.75 in this group. Although the prevalence of anisometropia in girls was higher, the difference was not statistically significant. This finding is consistent with the Taiwan study which found that the prevalence of anisometropia was 6% in 1995 and 7% in 2000. (Schih et al., 2005)

CONCLUSION:

To conclude, the current study showed many strengths of the previous studies, including a school-based study with a large sample size and a high response rate (89.3 per cent) which consolidates research findings. Especially (Alrahili et al., 2017) which may be the first to examine the magnitude of URE in very young children (3-10 years of age) in Medina. Moreover, the prevalence of URE, in particular astigmatism, was high among children 3-10 years of age in Medina, with significant age differences. Vision screening programs targeting kindergartens and primary school children are crucial in reducing the risk of the preventable visual impairment according to URE. Finally, the association of RE with age groups and gender was analyzed for different RE types. The current school healthcare program in Saudi Arabia lacks any system of child eye care. Therefore, the screening of children for refractive error and visual impairment should be conducted periodically (from kindergarten to grade 6 at a large-scale community level and should be integrated with regular school screening programs and in preschool health screening.

REFERENCES:

1. Wensor M, McCarty CA, Taylor HR. Prevalence and risk factors of myopia in Victoria, Australia. Arch Ophthalmol 1999; 117: 658-663.
2. Karande S, Kulkarni M. Poor school performance. Indian J Pediatr 2005; 72: 961
3. Tabbara KF, El-Sheikh HF, Shawaf SS, El-Sheikh MD, Shucri S, Shawaf MD. Pattern of childhood blindness at a referral center in Saudi Arabia. Ann Saudi Med 2005; 25: 18-21.
4. Resnikoff S, Pascolini D, Mariotti SP, Pokharel GP. Global magnitude of visual impairment caused by uncorrected refractive errors in 2004. Bull World Health Organ 2008; 86: 63-70.
5. Newman DK, Hitchcock A, McCarthy H, Keast-Butler J, Moore AT. Preschool vision screening: outcome of children referred to the hospital eye service. Br J Ophthalmol 1996; 80: 1077-1082.
6. American Association for Pediatric Ophthalmology and Strabismus (AAPOS). Vision Screening Recommendations, [cited 2014 May]. Available from URL: https://aapos.org/ terms/conditions/131
7. SAS Institute Inc. Proprietary Software Release 8.2. Cary (NC): SAS Institute Inc.; 1999.
8. Fotouhi A, Hashemi H, Khabazkhoob M, Mohammad K. The prevalence of refractive errors among schoolchildren in Dezful, Iran. Br J Ophthalmol 2007; 91: 287-292.
9. Ovenseri-Ogbomo GO, Omuemu VO; Dr V Omuemu. Prevalence of refractive error among school children in the Cape Coast Municipality, Ghana. Clinical Optometry 2010; 2: 59-66.
10. Gomes-neto JB, Hanushek EA, Leite RH, Frota-bezzera RC. Health and schooling: evidence and policy implications for developing countries. Econ Educ Rev 1997; 16: 271-282.
11. Bener A, Al-Mahdi HS, Vachhani PJ, Al-Nufal M, Ali AI. Do excessive internet use, television viewing and poor lifestyle habits affect low vision in school children? J Child Health Care 2010; 14: 375-385.
12. Bener A, Al-Mahdi HS. Internet use and television viewing in children and its association with vision loss: a major public health problem. J Public Health Africa 2012; 3: e16.
13. Al-Ghamdi SH. The association between watching television and obesity in children of school-age in Saudi Arabia. J Family Community Med 2013; 20: 83-89.
14. Murthy GV, Gupta SK, Ellwein LB, Muñoz SR, Pokharel GP, Sanga L, Bachani D. Refractive error in children in an urban population in New Delhi. Invest Ophthalmol Vis Sci 2002; 43: 623-631.
15. Dandona R, Dandona L, Srinivas M, Sahare P, Narsaiah S, Muñoz SR, Pokharel GP, Ellwein LB. Refractive error in children in a rural population in India. Invest Ophthalmol Vis Sci 2002; 43: 615-622.
16. Aldebasi YH. Prevalence of correctable visual impairment in primary school children in Qassim Province, Saudi Arabia. J Optom 2014; 7: 168-176.
17. Czepita D, Mojsa A, Ustianowska M, Czepita M, Lachowicz E. Prevalence of refractive errors in schoolchildren ranging from 6 to 18 years of age. Ann Acad Med Stetin 2007; 53: 53-56.
18. Yekta A, Fotouhi A, Hashemi H, Dehghani C, Ostadimoghaddam H, Heravian J, Derakhshan A, Yekta R, Behnia M, Khabazkhoob M. Prevalence of refractive errors among

schoolchildren in Shiraz, Iran. Clin Exp Ophthalmol 2010; 38: 242

19. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. Ophthalmology 2016; 123: 1036-1042.
20. Shih YF, Hsiao CH, Wen SH, Lin LL, Chen CJ, Hung PT. Prevalence of anisometropia in Taiwanese School children. J Fomos Med Assoc 2005; 104: 412
21. Bardisi WM, Bin Sadiq BM. Vision screening of preschool children in Jeddah, Saudi Arabia. Saudi Med J 2002; 23: 445-449.
22. AI Rowaily MA. Alanizi BM. Prevalence of Uncorrected Refractive Errors among Adolescents at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia. J Clin Exp Ophthalmol 2010; 1: 1-4.
23. Singh H, Saini VK, Yadav A, Soni B. Refractive errors in school going children: data from a school screening survey programme. Natl J Community Med 2013; 4:
24. Alrahili, N. H. R., Jadidy, E. S., Alahmadi, B. S. H., Abdula'al, M. F., Jadidy, A. S., Alhusaini, A. A., ... & Al-Barry, M. A. (2017). Prevalence of uncorrected refractive errors among children aged 3-10 years in western Saudi Arabia. *Saudi medical journal*, *38*(8), 804.