

# Vision screening of preschool children in Jeddah, Saudi Arabia

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## ABSTRACT

**Objective:** To determine the prevalence of Amblyopia and other refractive errors and to identify the factors associated with these disorders.

**Method:** The study was carried out in Jeddah, Kingdom of Saudi Arabia, in 1999, on children enrolled in governmental kindergartens during the academic year 1419-1420H. Children were screened for Amblyopia, any child who failed to pass the screening examination, was referred to the ophthalmologist for complete examination. A 95% confidence interval was used to describe the prevalence of eye disorders.

**Results:** The number of children referred to the ophthalmologists was 102. Out of this figure, 70% of children kept their appointment. Seventy-two children had decreased visual acuity of 20/30 or worse. The final

diagnoses were as follows: Amblyopia in 8 cases, which, give a prevalence rate of 1.3% (95% confidence intervals: 0.4-2.3); refractive errors in 50 cases (69%); strabismus in 4 cases (6%), duane syndrome in 2 cases (3%); and 8 children (11%) were completely normal. The positive predictive value of visual screening examination was 89%. We found no significant correlation between Amblyopia and the risk factors mentioned in the literature.

**Conclusion:** Vision screening is very important and recommended to be carried out as part of periodic health examination for pre school children. It is cost effective, highly sensitive, acceptable and easy to be administered.

**Keywords:** Amblyopia, vision, screening, preschool children.

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Amblyopia (lazy eye) is one of the most common causes of visual loss in children. If amblyopia is not treated early enough, it will persist and will not be corrected by occlusion therapy or by optical devices. The way to decrease the incidence of amblyopia is early detection at preschool age. Normal vision is important for leading a normal life and for good educational activities. Preschool children may suffer from impairment of vision due to different causes; many of these are preventable. One of the serious and preventable causes is amblyopia.<sup>1</sup> Amblyopia (lazy eye) is defined as reduced visual acuity without visible damage to structures in the eye or the visual system. It is regarded as developmental abnormality of the visual functions represented in the

visual cortex in the brain. The period during which amblyopia may occur extends from 4 to 6 months of age until 8 years. The so called "plastic period of visual development".<sup>2</sup> The 2 main clinical conditions responsible for amblyopia are strabismus and any disorder that causes a blurred retinal image in one or both eyes. For example a significant refractive difference between the eyes (anisometropia), or a very high degree of hypermetropia or myopia.<sup>1-3</sup> It was found to have some relation to factors such as gender ethnic group, family history, birth weight, perinatal factors and breast feeding. If amblyopia is not treated early enough, before the development of central vision, it will persist and will not be corrected by occlusion therapy, or by optical devices and the

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results of treatment are regarded very poor after the age of 8 years.<sup>4-7</sup> The main way to decrease the incidence of amblyopia is early detection through effective visual screening program for preschool children at age of 3 years to 5 years.<sup>7-10</sup>

Different procedures have been used for screening for amblyopia. For example visual acuity testing has been used, a level of 6/12 (20/40) or worse is usually adopted. Screening studies using stereoacuity tests have given excellent results. The prevalence rates of amblyopia in the Kingdom of Saudi Arabia (KSA) are varied between different areas. In 1994, the prevalence rate of amblyopia among the preschool children in Riyadh City, KSA was 2.6%, in Abha City (high altitude area, in the Southern Province of KSA) it was 1.9% among school children, and in Al-Asiah, KSA (low altitude area) the prevalence of amblyopia among school children was 3.3%.<sup>11-14</sup>

To date there is no published data on the prevalence of amblyopia and other ocular disorders among preschool children in Jeddah, KSA, and there is no adequate public health program of vision screening for preschool children. Therefore, there is a need to determine the prevalence of amblyopia and some other visual disorders of public health importance among this critical age before treatment becomes difficult or impossible. We hope this study may contribute in developing an adequate visual screening program that will lead to decrease the incidence of amblyopia in Jeddah, KSA.

The objectives of this study were 1. To determine the prevalence of amblyopia and other refractive errors among preschool children enrolled in kindergartens in Jeddah City, KSA. 2. To identify the factors and attributes associated with these disorders.

**Methods.** This study was carried out in Jeddah City, KSA, in 1999, on preschool children enrolled in governmental kindergartens during the academic year 1419-1420H. Unfortunately the health services provided to the preschool children in Jeddah, KSA, do not include adequate vision screening. General medical examination including visual screening examination, which is obligatory by law, is provided at school entry at the age of 6 years and above, when most of the changes of amblyopia become irreversible. However, visual screening for schoolchildren is often not carried out properly.

**Sampling technique and tools.** There were 1800 children enrolled in 20 governmental kindergartens distributed all over Jeddah, KSA. Kindergartens were selected randomly. The investigator (the author), received training on performing and interpreting the screening tests. All the parents were sent a letter to explain the main purpose of the study and received their acceptance to perform the test. All children were examined in a large well-illuminated room for visual acuity, light corneal reflex, ocular motility, near and distant vision, and stereoacuity. All the

information was recorded on a specially logbook and the information for those who need referral was recorded on a specially designed questionnaire. Children who were absent on the days of examination or having symptoms or signs of acute eye diseases, for example, conjunctivitis were treated by antibiotic eye drops or as needed and given another date for screening. The following data was collected for each child: 1. Personal history including name, age, sex. 2. Basic ocular and systemic history. 3. Results of visual acuity testing and other manifested eye disorders. 4. Results of ocular motility. 5. Results of the cover test. 6. Results of the stereoacuity. Any child who demonstrates the following: 1. Fails to pass the visual acuity testing (passing level is 20/30). 2. Fail to pass the stereoacuity testing (passing level 120 seconds) 3. Does not cooperate satisfactorily. 4. Any manifest or intermittent deviation during the cover test. 5. Showed abnormal ocular movements. 6. Showed any other eye abnormality or disorder was referred to the King Khalid National Guard Hospital or Eye Hospital to be seen by a Pediatric Ophthalmologist in order to perform a complete ophthalmologic examination; 1. Verify the screening results of screening examination and identify other unrecognized eye disorders. 2. Identify the factors and attributes that are associated with the eye disorders. 3. Provide the needed management.

**Data management.** Data was analyzed using a personal computer and Epi-Info software statistical package program. Ninety-five percent confidence intervals were used to describe the prevalence and distribution of the different eye disorders included in the study. Chi square test and Fischer exact test were used to demonstrate association between visual disorders and any possible risk factors based on the types of data collected.

**Results.** A total of 629 children were screened, their age ranged from 3 years to 5 years. The total number of children referred to the Pediatric Ophthalmologists was 102 children. Out of this figure, 72 (70%) children kept their appointment at the clinic and the rest (30%) did not, despite, many reminders and telephone calls. The mean age for those who kept their appointment was 4.2 years, the minimum age was 3.4 years and the maximum 5.6 years. Thirty-two (45%) of the 72 children reported to the hospitals were boys and 40 (55%) were girls. The parents of 25 (35%) children had noticed that their children might have decreased visual acuity as they sit near the television screen and the rest, 47 (65%) children were reported by parents to have no visual problems. Regarding the family history, 21 (30%) children had no family history (father, mother, or siblings) of using eyeglasses while 51 (70%) had family history. There was no family history of strabismus in 64 (89%) children while, it was

**Table 1** - Causes of referral to Pediatric Ophthalmology Clinics as a results of screening examination.

Finding	Frequency (%)
Decreased visual acuity	54 (75)
Decreased V/A+ strabismus	8 (11)
Decreased V/A+ decreased stereoacuity	8 (11)
Manifest squint	2 (3)
<b>Total</b>	<b>72 (100)</b>
V/A - visual acuity V/A+ - visual acuity positive	

positive in 8 (11%) children. The causes of referral to the pediatric ophthalmology clinics as a result of the screening examination were as follows. Fifty-four (75%) children had decreased visual acuity of 20/30 or worse and the rest 18 (25%) had other findings (**Table 1**). The final diagnosis reported by the pediatric ophthalmologists were as follows: Amblyopia in 8 cases (11%); Refractive errors in 50 cases (69%); Strabismus in 4 case (6%), Duane syndrome in 2 cases (3%); 8 children (11%) were completely normal (**Table 2**). The positive predictive value of visual screening examination was 89%.

In general the prevalence rate of vision disorders detected in our study was 10.7% (95% CI: 8.2 to 13.2), refractive errors 9% (95% CI: 6.7 to 11.3), hypermetropia (95% CI: 6.7 to 11.3), myopia 1.8% (95% CI: 0.8 to 2.9), anisometropia 1.5% (95% CI: 0.5 to 2.5), astigmatism 1.3% (95% CI: 0.4 to 2.3), and strabismus 0.7% (95% CI: 0.0 to 1.3) (**Table 3**). The prevalence rate of amblyopia was 1.3% (95% CI: 0.4 to 2.3). We found no significant correlation between amblyopia and some of the risk factors mentioned in the literature, like family history consanguinity or using eyeglasses, perinatal diseases or event, prematurity or breast feeding.

**Discussion.** Vision screening of the preschool age is of paramount importance, since detection of visual disorders at that stage can save the eye from amblyopia. The visual screening test that was carried out to detect visual disorders, was found to be highly sensitive and specific since its had 89% positive predictive value. The cover uncover test (objective test) was found to be highly sensitive for detection of malalignment, it was augmented by the use of other tests for the malalignment like light corneal reflex and ocular motility although it needed a few sessions of training for the investigator to improve the ability of interpreting the findings.

The stereoacuity tests (using the TNO book and special glasses and pass level of 120 second) although, were subjective and difficult for the minority of children, it was sensitive for detection of amblyopia cases. In spite of that, the visual acuity test is subjective. In our study it was found to be highly sensitive in detection of amblyopia cases, this was consistent with what was found in the literature that true positive rate was (98.9%), while the false positive is also high at (87%), we think this higher level was related to the type of the chart we used since the children in the kindergarten are well trained to recognise the hand figure as part of their educational curriculum, on the other hand the test was repeated twice for some children who were felt to have an inconsistent response since they were reported to improve the results of screening to avoid over referrals.<sup>15,16</sup> By our screening, we detected 8 children already with developed amblyopia, who were lucky to receive the appropriate management in the right time. Four cases of strabismus, 9 cases of anisometropia, 8 cases of high grade of hypermetropia were saved from possible amblyopia by early detection and treatment.

The prevalence of vision disorder detected in our study was (10.7%) which is similar to the usual prevalence worldwide which, ranged between 10%-20%. The prevalence rate of amblyopia in our study was 1.3% which is consistent with the worldwide prevalence which ranges from 1%-4%. Although it is slightly less than the Riyadh study which was the only local study on this age group in 1994, where they found the prevalence of amblyopia to be 2.6%, this may be related to the larger sample size and the test being carried out by ophthalmologists.<sup>13</sup>

**Table 2** - The final diagnosis reported by the Pediatric Ophthalmologist.

Diagnosis	Frequency (%)
<b>Amblyopia</b>	8 (11)
Anisometropia	4
Strabismus	2
High refractive error	2
<b>Malalignment</b>	4 (6)
Esotropia	3
Exotropia	1
<b>Refractive errors</b>	50 (69)
Anisometropia	9 (13)
Hypermetropia	22 (31)
Mild	14 (19)
Moderate	8 (11)
Myopia	11 (15)
Astigmatism	8 (11)
Duane syndrome	2 (3)
Normal	8 (11)
<b>Total</b>	<b>72 (100)</b>

**Table 3** - Prevalence rate for visual disorders.

Diagnosis	Frequency	Prevalence Rate (95% CI)
<b>Amblyopia</b>	8	1.8 (95% CI:
Anisometropia	4	0.8 to 2.9)
Strabismus	2	1.5% (95% CI:
High refractive error	2	0.5 to 2.5)
<b>Malalignment</b>	4	0.7% (95% CI:
Esotropia	3	0.0 to 1.3)
Exotropia	1	
<b>Refractive errors</b>	50	9% (95% CI: 6.7
Anisometropia	9	to 11.3)
Hypermetropia	22	
Mild	14	
Moderate	8	(95% CI: 6.7
Myopia	11	to 11.3)
Astigmatism	8	
		1.8% (95% CI:
		.8 to 2.9),
		1.3% (95% CI:
		0.4 to 2.3)
Duane Syndrome	2	
Normal	8	
<b>Total</b>	<b>72</b>	
CI- confidence intervals		

Comparing our results with other local studies, In Abha city (high altitude) a study on school boys aged 6 years-12 years in 1994, they found the prevalence of amblyopia (1.9%), same as that carried out in Al-Baha, KSA (high altitude), (1.9%), although it was reported as high as 3.3% in Al-Asiah, KSA (low altitude area) in 1994.<sup>11-14</sup> Regarding the prevalence rate of refractive errors in our study (9%) which, was consistent with the prevalence in Al-Baha, KSA (7.2%) by Al-Faran,<sup>13</sup> but it was much higher than the study in Riyadh (1.9%), this was as refraction was carried out only for those of strabismus.<sup>11</sup>

We found high prevalence of hypermetropia (3.6%) compared with other types of refractive errors we think this may be related to the physiological hypermetropia which is common at this age (children have small eyes) which can improve as the child gets older. The prevalence of strabismus in our study was (0.7%) similar to Al-Baha, KSA, (0.5%), but was less than that found in Riyadh, KSA study on the preschool children which was (1.2%), this may be due to the high specificity of the cover test which was performed by the Ophthalmologist.

In general the strabismus prevalence in the KSA was found less than that of United States of America (USA), which ranged between 1.3%-9% average of

48 (4%).<sup>7</sup> Although family history of vision disorder was positive in 70% of the cases, we did not find any significant correlations between vision disorders and the risk factors mentioned in the literature such as consanguinity, prematurity, perinatal illness or breast feeding.<sup>17-18</sup> This may be due to the small sample size, and lack of proper control group. Interestingly 65% of the parents of those affected children did not notice any problems of vision of their children when they were questioned, only 35% reported noticing their children sitting near the television. This indicates that the disorder is most of the times symptomless at this age, since it will not affect the child's usual activity. Although we detected 102 cases only 72 (70%) kept their appointment to the hospitals to have the confirmatory testing, the rest (30%) dropped out, and did not respond despite many reminder letters through the school headmistress, and telephone calls.

In conclusion, vision screening is very important, recommended to be carried out as part of a periodic health examination for preschool children age group.<sup>5,7,11,16</sup> It is carried out quite effectively in many developed countries, where it helped to decrease the incidence of amblyopia which is a most serious disorder, since other disorders can be improved if it is detected and treated at school age. The screening program is cost effective, highly sensitive acceptable and easy to be administered with some training of the primary healthcare physicians, and nurses.

**Recommendations.** 1. Increase awareness of the primary care personnel (family physicians-board certified in family medicine practice), general practitioners, doctors and nurses working in well baby clinics, of the importance of vision screening at this age group. 2. Offer vision screening for each child aged 3 years -5 years coming to the primary health center, either for regular well baby clinic visit, vaccination, or visit to the family physician for any other reasons. 3. Visual acuity testing can be used as screening until other tests can be established. 4. Plan for inter-sectoral cooperation between Ministry of Health and Ministry of Education to develop and organize the vision screening program in a way which provides a good percentage of coverage for this age group. 5. Referral for those with low visual acuity less than 20/30 or 6/9, with difference of more than 2 lines between each eye on the chart, manifest strabismus, ptosis, cataract, or any other abnormality of vision to the ophthalmologist for complete examination and management. 6. Increase the awareness of the public regarding the importance of early detection and treatment of vision problems via the screening programs, and correction for any wrong health beliefs regarding vision of children, this can be accomplished through health education, either face to face with parents, lectures in the primary care centers, or mass media.

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