

Visual Acuity and Refraction of Libyan School Pupils in Comparison to Preschool Children

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ABSTRACT

Error of refraction is a socioeconomic problem of life, its effects vary from living with blurred vision, lost opportunities to work in certain jobs, to risking becoming blind because of potential loss of the sound eye. This study is aimed to find the prevalence of refractive error among school age children and compare it to that of preschool children by other statistics. Visual acuity (VA) and auto refraction and correction of error of refraction by lenses were performed on 1127 students of first year primary, preparatory and secondary school age in Tripoli schools (April 2008 to April 2009). Approximately one third of students were found with defective vision due to an error of refraction with a high incidence of mixed myopia, hyperopia, myopic astigmatism, myopia, then others with a power of refraction varies from zero to 4 D and increasing from 4 to 10 D. With increase incidence of marked difference between both eyes (anisometropia), which increases the chance to develop lazy eye (amblyopia) in future which differs from preschool and other statistics. The study found that, high incidence of error of refraction among school age in comparison to other statistics and same as preschool age.

We would like to recommend that, the checking of VA and refraction should be performed for preschool age children and regularly for school age children to fully resolve this socioeconomic problem among students if detected early and treated.

Keywords - Visual acuity; Refraction; Myopia (-); Hyperopia (+); Astigmatism (cylinder); Anisometropia; D (diopetre); Amblyopia.

INTRODUCTION

Refractive error is an error in the focusing of light by the eye, it is a frequent cause of blurred and reduced vision.¹ The primary refractive errors are near sight (myopia), farsightedness (hyperopia) and astigmatism. It is estimated that 2-3 billion people worldwide have refractive error, out of which 108 million have access to adequate eye examination and affordable correction however this leaves 500 million mostly in developing countries, with uncorrected errors causing either blindness or impaired vision.² The World Health Organization launched the Global initiative vision 2020 in 1999 with the slogan "the right to sight" that has five priority areas; error of refraction is one of them.³

At birth practically all eyes are hyperopia to the extent of +2.5-3 D, due to short axial length. As the growth of the body proceeds the length of the eye increases until adolescence has passed when the eye should, theoretically, be normal in size and refraction.

Refractive error has been found to cluster in families, a variety of inheritance pattern has been observed to including dominant and recessive genes, but, also a combination between genes and the environment (multifactorial) has been observed⁴, hyperopia and astigmatism both seem to be at least partially genetically determined.⁵ Refractive error of a certain power, which can be unilateral or bilateral, if not treated at an early age of life can lead to permanent defective vision (amblyopia).⁶

Risk factors in developing amblyopia were defined as bilateral spherical refractive error equal to, or more than, +4 D or -6 D, as astigmatism of 2.5 D, anisometropia equal to, or more than 1.5 D with regards to hyperopia and astigmatism and equal to, or more than 2.0 D in myopic anisometropia and constant unilateral strabismus.⁷

Children rely on their vision in their learning processes. If they have difficulty in seeing, this handicap affects academic performance and thus any visual problems should be corrected properly. This study aims to determine the incidence of refractive errors among students of different levels of school age in comparison to the preschool age, it is important to note that beyond that certain level of error of refraction, if not corrected early, can lead to amblyopia which is a socioeconomic problem.

MATERIALS AND METHODS

Visual acuity using the Snellen chart and automated refraction was performed on students at Tripoli schools:

1st year of primary school, 6 years old (534 students);

1st year of preparatory school, 12 years old (383 students);

1st year of secondary school, 15 years old (210 students).

Use of the E-letter Snellen chart and Topcon RM-A2300 was employed during April 2008 to April 2009.

Correction with lenses was tried and prescription glasses were given.

RESULTS

Of 1127 students examined only 2141 eyes refractions was performed as others did not attend during the examination with auto refraction.

When VA was checked, it was found that a high number of students could see the Snellen chart (for the first time) as 80.5% of 1^{ry} School, 59.5% of preparatory School and 50% of 2^{ry} School (Figure 1).

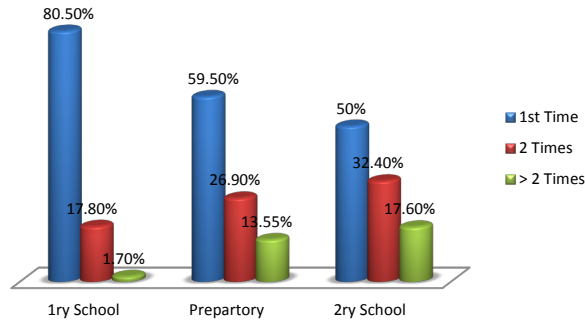


Figure 1: Visual acuity check up.

- Normal vision of (6/6-6/4) was found in 66.5% of our students (Figure 2), with females showing less incidence than males (Figure 3).

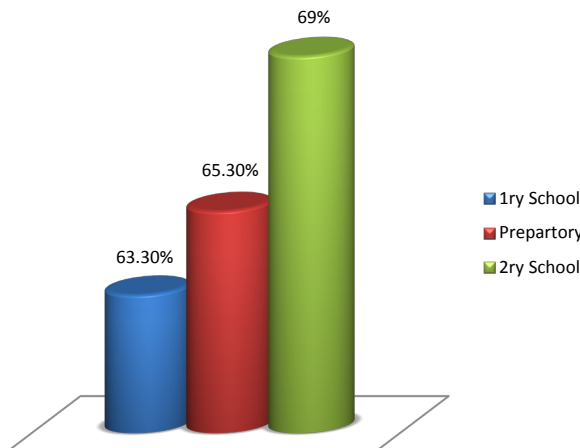


Figure 2: The incidence of normal VA of students.

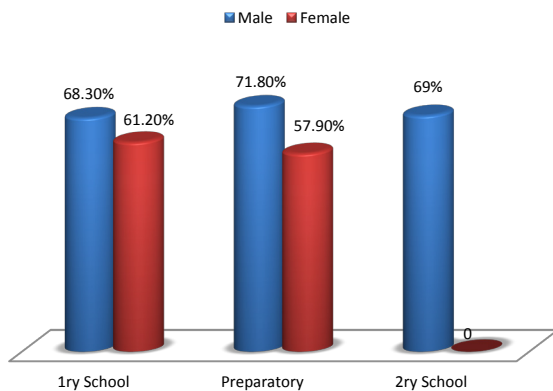


Figure 3: Difference of sex in this study explains the better VA in 2^{ry} School.

- Subnormal vision (Figure 4):

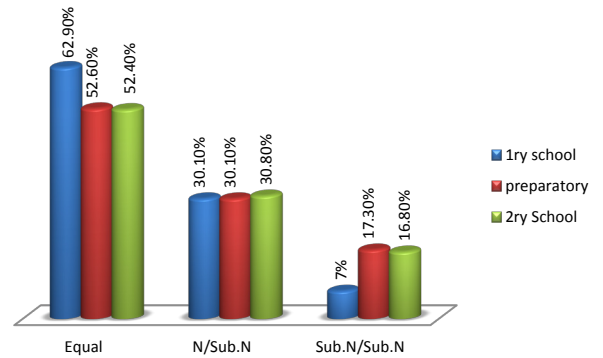


Figure 4: Subnormal VA in both eyes. Subnormal Vision (< 6/6-6/4)

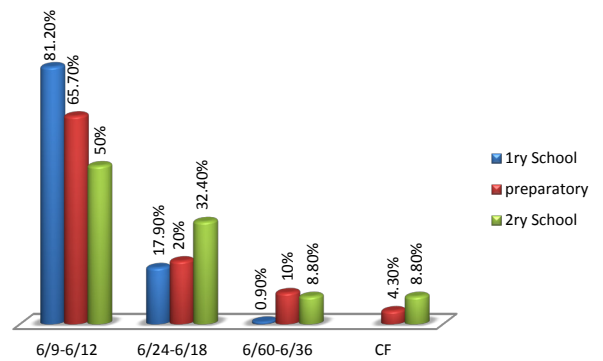


Figure 5: Equal levels in both eyes.

1- (Below 6/6) *in one eye*: occurred at about 30% had the same order of incidence in primary, preparatory and secondary school.

2- (Below 6/6) *in BEs*:

A- *Equal level of VA*: better in 1ry school 62%, which is less and same in preparatory and secondary school, about 52% (Figure 5).

B- *Unequal*: is more incidences in preparatory and secondary schools about 17%, in comparison to 7% in 1ry School.

- Anisometropia was noticed to increase from preparatory to secondary schools in association with the progression of subnormal levels of VA, with an average of 44% occurrence (Figure 6 and 7).

- Mixed type myopia was found to be the most common error of refraction, followed by mixed hypermetropia, myopic astigmatism, then myopia and then others (Table 1; Figure 8).

- In relation to the level of VA:

- The power of refraction was found to be between zero to 4 D in students with VA 6/4 -6/24, and increased from 4 D to >10 D in students with a VA 6/36 or worse (Table 2; Figure 9 a and b).

- Amblyopia was not seen when VA was equal in both

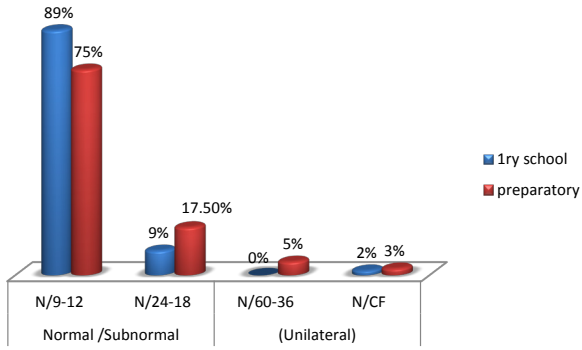


Figure 6: Unilateral subnormal vision.

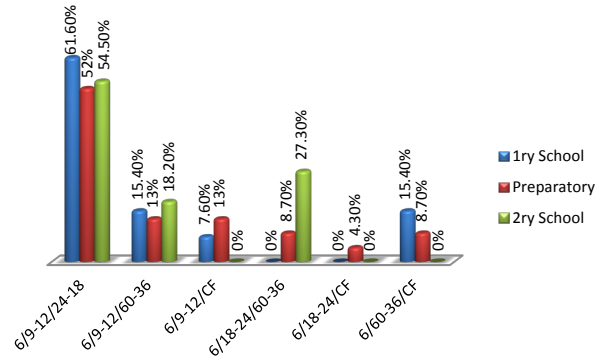


Figure 7: Subnormal vision in both eyes.

Table 1: VA with type of refraction.

| | 6/6-6/4 | 6/9-6/12 | 6/18-6/24 | 6/60-6/36 | CF |
|-----------|---------|----------|-----------|-----------|----|
| Mixed (-) | 689 | 191 | 59 | 28 | 15 |
| Sph+/Cyl- | 482 | 178 | 57 | 4 | 2 |
| Cyl (-) | 294 | 35 | 6 | 1 | 0 |
| Sph (-) | 53 | 8 | 1 | 0 | 2 |
| Sph (+) | 9 | 1 | 0 | 0 | 0 |
| Cyl (+) | 2 | 0 | 0 | 0 | 0 |
| Sph-/CYL+ | 3 | 0 | 0 | 0 | 0 |
| Mixed (+) | 5 | 0 | 0 | 0 | 1 |
| Zero | 14 | 0 | 0 | 0 | 0 |

* Error of refraction was mainly mixed (-)---->Sph+/Cyl (-) ----->Cyl (-) *Zero refraction is very very rare. * VA of (6/6- 6/4) doesn't mean an emetopic eye .

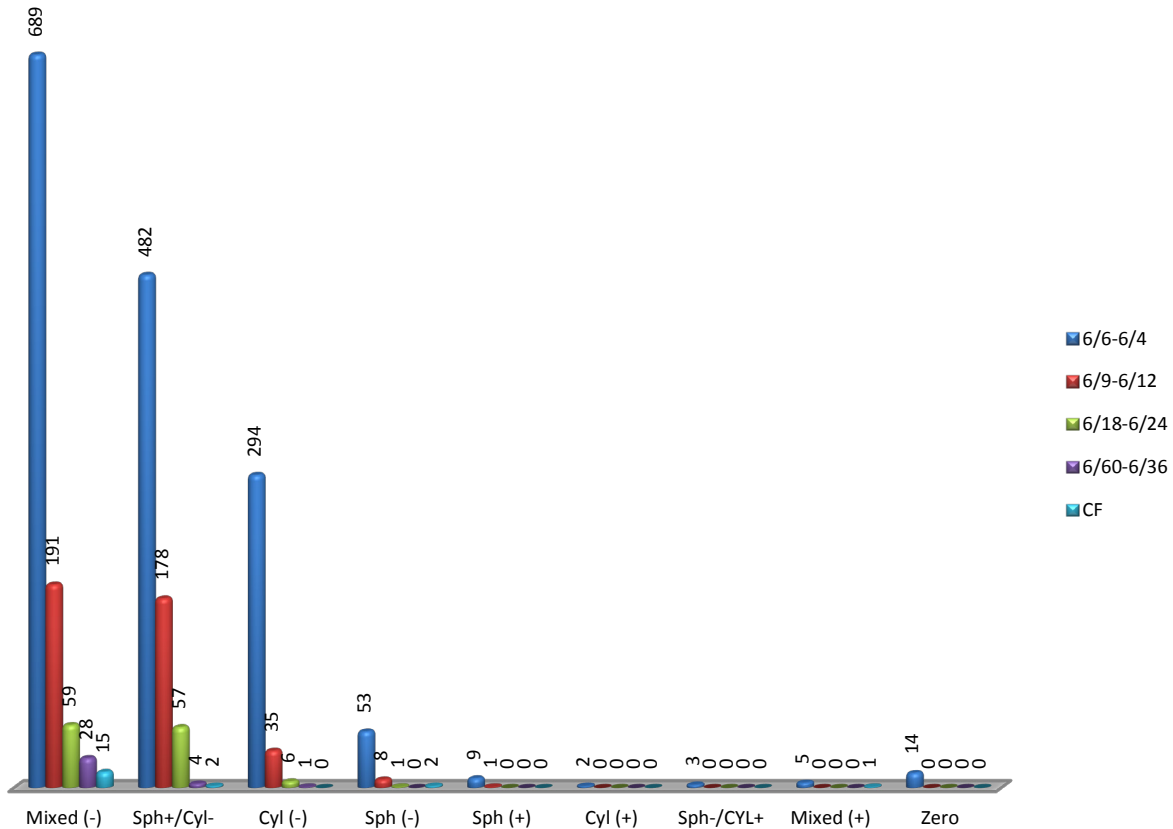


Figure 8: VA with type of error of refraction.

eyes with a level of VA 6/24 or better and an error of refraction up to -5.75 D. Also, it was not seen in unilateral subnormal VA 6/24 or better, If the error of refraction was the major myopic type and below -6 D. Amblyopia was seen when VA was unequal in both eyes with an error of refraction of hyperopic type with +2 D or more or high cylinder.

Amblyopia in this study

Incidence:

- 1ry School: 24 cases (4.5%)
- Preparatory: 32 cases (8.4%)
- 2ry School: 16 cases (7.6%)

Causes:

1ry School:

- VA 6/9-6/12 with +2 Sph/-2 Cyl or more .
- VA < 6/9-6/12 and equal in BE with high+, highCyl or both.
- Anisometropia with high+, highCyl or both.

But not seen in VA up to 6/24 with – Sph up to 9D

Preparatory School:

- Cyl > 3 D (46.9%)
- High +> 2.5 D/Cyl >2 D (28 %)
- High (-) Sph / High Cyl (12.5%)
- High (-) Sph > 12 D in one eye (12 %)
- Aphakia, Squint (0.5 %)

2ry School: (high – Sph)

Anisometropia: 3 lines or more defect in the chart. Using glasses recently or since Preparatory School but irregular use, or no glasses before.

Very poor VA (CF), Regardless use glasses at late 1ry school (9 years old or more).

Surgery on the eye (glaucoma, cataract).

- It was noticed increase number of students in need for glasses correction, with myopia in preparatory and secondary school (Figure 10 a and b). Also increase of hyperopic and astigmatism in primary school as among Libyan preschool age when compared with previous study.¹⁶

Table 2: VA and refraction power.

| | 6/6- 6/4 | 6/9- 6/12 | 6/18- 6/24 | 6/36- 6/60 | CF |
|---------|----------|-----------|------------|------------|----|
| <1.0 D | 1180 | 180 | 9 | 0 | 0 |
| 1-2 D | 242 | 149 | 54 | 4 | 1 |
| >2-4 D | 46 | 71 | 47 | 8 | 5 |
| > 4-5 D | 4 | 4 | 9 | 8 | 5 |
| >5-7 D | 4 | 7 | 4 | 10 | 2 |
| 7.5-8 D | 1 | 0 | 0 | 0 | 2 |
| 9 D | 0 | 0 | 0 | 1 | 3 |
| > 10 D | 0 | 0 | 0 | 2 | 1 |

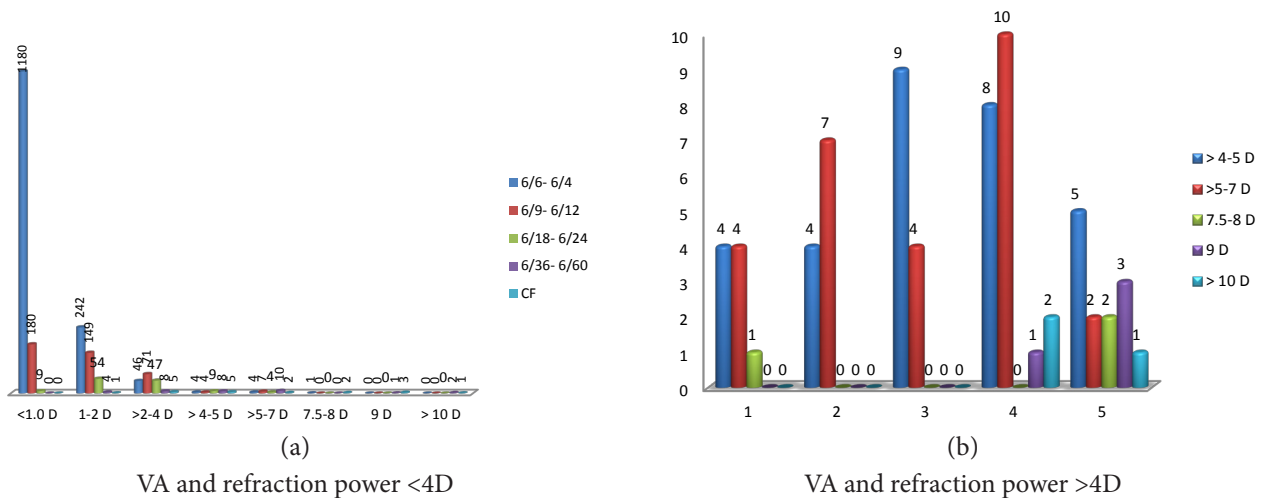


Figure 9 a and b: VA in relation to the power of refraction.

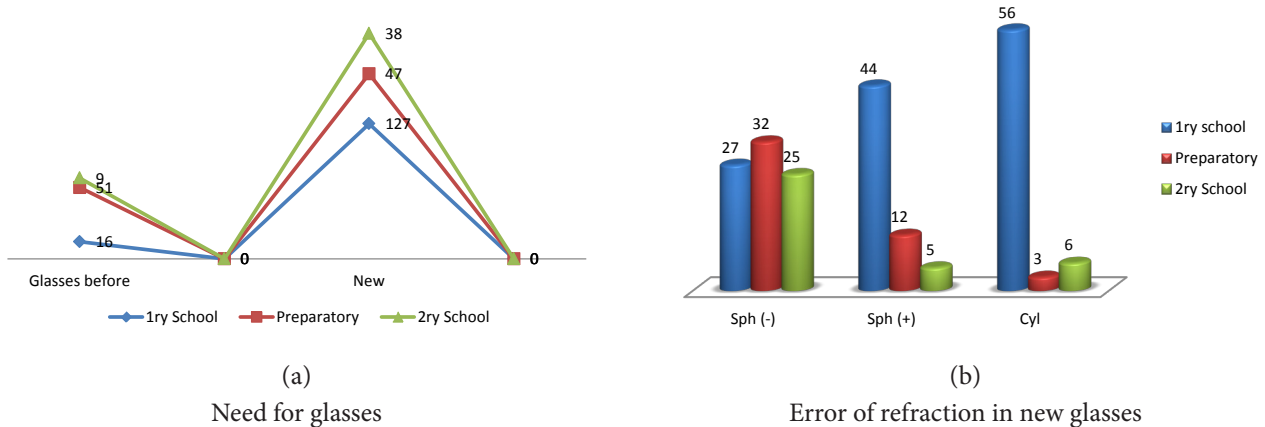


Figure 10 a and b: The prescribed glasses and the type of refraction.

DISCUSSION

Refractive errors of the eye are seen in 20% of children, the most common being astigmatism, hyperopia and myopia. Hyperopia and astigmatism were found to be the most prevalent refractive error. Amblyopia due to error of refraction, was found to be 11% in comparison with amblyopia 2-3%, isometric amblyopia, 1-2% of all refractive amblyopia, which is found to be 8% in general population.⁸

Most of preschool children in the highly astigmatic population are hyperopic, with high prevalence of hyperopic sphere and hyperopic astigmatism in large group of 3 to 4 years old.⁹ It has been reported that 15.2% of people have refractive error and 3.62% have an amblyopia in young people of age 20 to 40 years.¹⁰

In Pakistan, 11.4% of blindness is due to uncorrected refractive error. In High School (2^{ry} School), 19.8% of the students have refractive error, with the incidence of myopia being 43%, astigmatism 35.5% (simple and compound) and 21.5% hyperopia.¹¹

In India, the prevalence of uncorrected error of refraction among urban and rural School children at Maharashtra India was found to be 3.16% for myopia, 1.06% for hyperopia and 0.16% for astigmatism with lower incidences in rural areas.¹² In North West Ethiopia, the prevalence of refractive error among school children in Gondar Tawon was found to be 31.6% for myopia and 26.4% for hyperopia, low myopia being the most refractive error and is common in people in Gondar Tawon¹³, while in Debarik Kola Diba Tawon, error of fraction was found to be 7.6% in the population, with myopia being more dominant at 98%.¹⁴

There was no evidence for a myopic shift over preschool children, a small proportion would likely benefit from refractive correction, but few has had this prescribed.¹⁵

The prevalence of subnormal refraction error was found to be 34.8% in Libyan preschool children in Tripoli: 52% with mild hyperopia, 25.5% with mild astigmatism and 22.5% with mild myopia¹⁶ whilst the prevalence of error of refraction among preschool children in Saudi Arabia

(Riyadh) was found to be 4.5%, with 2.5 % due to myopia, 2.1% hyperopia and 2.5% astigmatism.¹⁷

The distributed refractive error rates in African-American preschool children was found to be 6% myopic, 15.4% hyperopia, 12% astigmatism and 6% anisometropia.¹⁸ Significant refractive error is uncommon in preschool age children with no evidence for a myopic shift over this age,¹⁹ whereas 22.5% school children had undiagnosed myopic error in the Barrio Santino E level school, San Pablo city.²⁰

CONCLUSION

-Increase prevalence of subnormal vision among Libyan school students in this study which was 33.5%, it is not differ much from prevalence of Libyan preschool children which is 34.8%. It is considered very high among preschool children in comparison with other statistics of third World, which varies from 4.5% to 22.5%.

-The error of refraction among Libyan school age was mostly mixed myopia, mixed hyperopia, myopic astigmatism, then myopia. While other statistics show high incidence of myopia, then hyperope, then astigmatism, while in pre School Libyan children towards hyperopia, then astigmatism, then myopia.

-High prevalence of anisometropia (average 44%) and amblyopia (4.5- 8%) in this study in comparison with other studies 3.5% to 5.5% is due to error of refraction.

-Early correction with glasses is the key for normal vision.

RECOMMENDATIONS

-Testing of refractive error should be included in programmes used to detect vision disorders in preschool children. Effective detection will decrease the incidence of amblyopia.

-Visual acuity and refraction should be performed as a routine examination at preschool and the 1st year of each level of primary, preparatory and secondary school with prompt correction being given.

-Further comparison with other areas of Libya is recommended.

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