



## Original article

# Screening of refractive error among primary school students at Tanta City Gharbia governorate Egypt. How serious is the problem?



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## ABSTRACT

**Objectives:** Determine the prevalence of refractive errors among school children comparing governmental and non-governmental schools.

**Patients and methods:** This study was a school-based cross-sectional comparative study, conducted in Tanta city, Gharbia governorate in the middle of the Delta region, Egypt from January and April 2016. The study included 1075 students from Two groups of primary schools private and governmental. Sociodemographic data collected for all student and full ophthalmic examination were done.

**Results:** The prevalence of refractive error in our study was 22.1% of all students, only 35.7% of RE students wore glasses before our screening and suspected amblyopia cases who were 31.1% of RE students (6.9% of all students). Distribution of different types of refractive error showed that astigmatism most common followed by myopia and lastly hyperopia (68.1%, 17.6%, and 14.3% respectively).

**Conclusion:** About one-fourth of the students had a refractive error with high suspected amblyopia. Most of the refractive error cases especially in governmental school were first detected during our study.

## 1. Introduction

The global initiative for Elimination of Avoidable Blindness (2001) sets a major challenge of work to avoid the preventable blindness. Refractive Errors (RE) has been listed as one of the most common causes of visual impairment and the second leading cause of preventable blindness following cataract.<sup>1</sup>

Dandona et al. (2006) reported that 12.3% of total blindness was due to uncorrected refractive error. RE is also responsible for a large number of blind years lived by a person than most other causes if left uncorrected. It was estimated that blindness due to refractive error resulted in an average of 30 years blindness for each person as compared with 5 years of blindness due to untreated cataract.<sup>2</sup>

Uncorrected refractive errors is an important cause of visual impairment in children. As reported in a study conducted in South Sinai, Egypt schoolchildren where refractive errors represent 90.32% of visual impairment causes.<sup>3</sup>

Many studies carried out in Egypt revealed that the prevalence of refractive errors in school children ranged from 13.4% to 39%.<sup>4,5</sup> Also, other studies showed that refractive error was responsible for 1.1%

legal blindness (which is defined as vision less than 6/60).<sup>6</sup>

Refractive errors can be easily detected and corrected by the use of glasses saving many years of blindness, this motivated us to carry out the present study.

## 2. Aim of the work

Determine the prevalence of refractive errors among school children comparing governmental and non-governmental schools.

## 3. Patients and methods

**Study design:** This study was a school-based cross-sectional comparative study.

**Study setting and time:** this study conducted in Tanta city, Gharbia governorate in the middle of the Delta region in Egypt from January and April 2016.

Two groups of schools selected based on the difference in the social standard as the private school fees were (10000–30000 Egyptian pounds/year compared to 200 pounds for governmental school).

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**Sampling:** The sample size calculated using the Epi-Info program of statistics, version 7.1.5.2. Based on a level of significance of 95%, 80% power of the study, the estimated prevalence of VDTs use of 50% and error of 5%, the sample size estimated to be 384. The sample was increased to 550 for each group (total 1100 students for both groups) to improve the validity of the results and to cover any losses due to incomplete examination.

For each group of school students, a multistage probability sample technique chose five hundred and fifty children. First, Tanta Educational Administration divided into east and west. Random selection of one primary school (a cluster) from the east and another from the west for each type of school (governmental and private). Eight classes were chosen randomly from each school (two from each grade 3rd, 4th, 5th, and 6th) as the average student/class was 40 students.

**Inclusion criteria:** The study included all children in grades 3 to 6 at the selected classes who completed the study properly.

**Exclusion criteria:** Children with visual impairment due to causes other than refractive error excluded from this study.

At the end of data collection, only 1075 students (543 of private school and 532 of governmental school) met the inclusion criteria, gave the consent and completed the examination with a response rate 97.72%.

**Data collection included:** Sociodemographic data: as sex, age, grade.

#### 4. Ophthalmic examination

Monocular visual acuity (VA) was measured. Also, Best Corrected Visual Acuity (BCVA) with glasses for students who wore glasses. Assessment of VA done using the bracketing technique at the school using Landolt broken ring self-illuminated chart at 6 m in a dark room at school. The visual acuity recorded for each child and suspected amblyopia cases detected.

External eye examination and anterior segment examination using a portable slit lamp (Topcon). Red reflex examination using direct ophthalmoscopy.

Measuring the refraction using (plussioptix A12 R USA manufactured tool) as a portable photo-refractor device. This tool is a noninvasive, infrared video recorder linked to a laptop computer with proprietary software for evaluation. The device measures the refractive data. During normal use, the examiner holds an infrared projector/recorder approximately 1 m from the patient. The device produces noises to confirm the fixation of the patient's gaze.

**Definitions of visual impairment and different refractive errors:** Comparison between studies in different ethnic origins and cultural settings was possible by applying certain definitions to provide grounds for accurate and valid comparisons.

Also, the refractive errors were recorded in spherical equivalent (SE) values to categorize the different types of errors.

Visual impairment is defined as an optimal VA  $\leq$  20/40 [equal to or worse than 6/12] in the better eye. Myopia defined as a spherical equivalent (SE) of - 0.50 diopter (D) or worse. Myopia categorized as mild ( $\geq$  - 0.5 D to  $\leq$  - 3.0 D), moderate ( $\geq$  - 3.1 D to  $\leq$  - 6.0 D), and high (worse than - 6.0 D). Hyperopia as SE of +2.00 D or more, Hyperopia was categorized as mild ( $\geq$  +2.0 D to  $\leq$  +3.9 D), moderate ( $\geq$  +4.0 D to  $\leq$  +5.9 D) and high ( $\geq$  +6.0 D). Astigmatism was defined as cylinder equal to or worse than 0.75 D. Anisometropia is a difference of 1 D (SE) between both eyes. Unilateral amblyopia is difference in BCVA between both eyes of two lines or more. Bilateral amblyopia is those who have BCVA of 6/12 or less in both eyes. Suspected amblyopia cases referred to University Hospital for further examination.<sup>7,8</sup>

#### 5. Data analysis

Statistical analysis done using the SPSS program (SPSS, Version 21.0

**Table 1**  
Socio-demographic characteristic of the studied groups.

Socio-demographic characteristic	Private school 543		Governmental school 532		$\chi^2$ /or T P
	No	%	No	%	
Age					
• 9-10	288	53.0	257	48.3	T (1.72)
• 11-13	255	47.0	275	51.7	P = 0.058
Mean $\pm$ SD	10.79 $\pm$ 0.92		10.89 $\pm$ 0.98		
Sex					
• Male	249	45.9	235	44.2	308
• Female	294	54.1	297	55.8	0.58
Grade					
• 3rd and 4th	264	48.6	246	46.2	0.609
• 5th and 6th	279	51.4	286	53.8	0.434

$\chi^2$  chi square, T test.

Inc., Chicago, Illinois, USA). Qualitative data summarized as numbers and percentage. The non-parametric tests of significance (chi-square test) applied for comparison between groups. Quantitative data presented as the mean and standard deviation. The p-value was two-tailed and statistical significance was set at 0.05.

#### 6. Ethical considerations

Official approval obtained from the ethics committee of the Tanta faculty of medicine.

#### 7. Results

The current study carried out in governmental and private primary schools. It included 1075 students (543 from private school and 532 from governmental school), they were in grade (3–6), 55% female and 45% male. Their age range was from 9 to 13 with mean age and standard deviation (10.79  $\pm$  0.92) in private schools and (10.89  $\pm$  0.98) in governmental school.” [Table 1](#)”.

There was high prevalence of refractive error as more than one fifth of the students (22.1%) had refractive error, it was significantly higher in governmental than private schools students (30.8%, 13.6% respectively) [Table 2](#).

More than one third of refractive error students had amblyopia (31.1%) also about two third of refractive error detected by screening (64.3%) with a significantly higher figure in governmental schools (81.7%). Another finding was elicited, anisometropia significantly higher in private schools (39.2%), [Table 3](#). The most common type of error was astigmatism (15.1% of all studied school students had astigmatism, followed by myopia 3.9% then lastly hyperopia 3.2%) with no significant difference in distribution between private and governmental school students [Table 4](#).

#### 8. Discussion

The present study carried out in Tanta city primary schools. It included 1075 students (543 from private school and 532 from governmental school) grade 3 to 6, most of them 55% were females and 45% males. Their age range was from 9 to 13 with mean age and standard deviation (10.79  $\pm$  0.92) in private schools and (10.89  $\pm$  0.98) in governmental school.

The prevalence of refractive error in our study was 22.1% of all students, which agrees with El-Bayoumy M. (2007) finding in a study carried out in Cairo, who reported 22% out of 5839 students aged 7–15 years had RE.<sup>9</sup> Also near to Elkota MM (2016) finding in Menouf district, Egypt as 24% of 480 students aged 6–12 had RE.<sup>10</sup>

On the other hand our finding was higher than Rashad MA et al. (2018) in Cairo as 13.4% out of 352 school students aged 8–12 years

**Table 2**  
Distribution of Visual impairment in the study groups (according to Visual Acuity VA measurement).

Visual impairment	Visual acuity	Private school 543		Governmental school 532		Total 1075	
		No	%	No	%	No	%
No visual impairment	6/6	332	61.0	268	50.4	600	55.8
	6/9	137	25.2	100	18.8	237	22.0
Total (N = 837)		469	86.4	368	69.2	837	77.9
Visual impairment	6/12	41	7.6	68	12.8	109	10.1
	6/18	12	2.2	39	7.3	51	4.7
	6/24	2	0.4	20	3.8	22	2.0
	6/36	5	0.9	9	1.7	14	1.3
	6/60	7	1.3	6	1.1	13	1.2
	< 6/60	7	1.3	23	4.3	30	2.8
Total (N = 238)		74	13.6	164	30.8	238	22.1

$\chi^2 = 46.11$  p = 0.00001

$\chi^2$  chi square \* significant at P < 0.05.

had RE.<sup>4</sup> Also, lower figure was reported by Vidusha KS (2018) in India, as the prevalence rate was 10.5% in a study included 1140 school children aged 7–16.<sup>11</sup> This difference in finding may be due to different study design, sample size and/or age of students included in the study.

The present study revealed that only 35.7% of RE students wore glasses before our screening which was significantly higher in private school children 74.3% of RE students. This figure was different than reported in Cairo school students as 42.3% of refractive error students wore glasses which is not related to the socioeconomic standard.<sup>9</sup>

This may be due to more effectiveness of the screening program carried out in Cairo schools and Tanta private schools, or better socioeconomic standard and parent awareness about RE problem in private school children.

Suspected amblyopia cases that referred for further investigation in University Hospital were 31.1% of RE students (6.9% of all students), this was much higher than those reported in Cairo (2018) of 13.4% suspected amblyopic children out of all examined primary school children.<sup>4</sup> This different figure which more evident in governmental school may be due to the higher percent of undiscovered RE in them (81.7% of RE governmental student did not wear glasses). This raises the importance of implementation and good monitoring of the school RE screening program to avoid the occurrence of amblyopia.

Distribution of different types of refractive error in the present study showed that astigmatism most common followed by myopia and lastly hyperopia (68.1%, 17.6%, and 14.3% respectively). This disagrees with other Egyptian studies that reported myopia as most common followed by hyperopia and lastly astigmatism (70.2%, 27.6%, and 25.5% respectively).<sup>4</sup> Another study in India reported myopia followed by astigmatism and lastly hyperopia (58.5%, 24.4%, and 17.1% respectively).<sup>11</sup>

On the other hand, our finding agrees with Hashemi H (2017) finding in systematic review and meta-analysis that astigmatism was

the most common refractive error in children.<sup>12</sup>

This variation can be explained by using different methods in the evaluation of RE type. In the present study, we used the (Plusoptix A12 R USA manufactured tool) photorefractory device which gives an accurate evaluation of RE and better detection of astigmatism than retinoscopy. Study limitation is the unequal number of boys and girls; girls had a higher participation rate both in governmental and non-governmental school. Gender specific prevalence may show different figures if considered.

### 9. Conclusion

Refractive error is an important problem in schoolchildren. There was high prevalence of refractive error (22.1%), the most common type of error was astigmatism (15.1% of all students had astigmatism, followed by myopia 3.9% then lastly hyperopia 3.2%). Suspected amblyopia that leads to permanent visual loss is high. Most cases of refractive error especially in governmental school first detected during our study.

### Recommendation advances in knowledge

Large scale study including middle and high school students is highly recommended.

Health authority to screen school students for refractive errors on stages to avoid preventable blindness in the future.

### Financial support and sponsorship

Nil.

**Table 3**  
Optic criteria of students with refractive error.

Visual impairment criteria	Private school 74		Governmental school 164		Total 238		$\chi^2/P$
	No	%	No	%	No	%	
Students with refractive error:	55	74.3	30	18.3	85	35.7	69.7
Wearing glasses							0.00001*
Not wearing glasses	19	25.7	134	81.7	153	64.3	
Suspected Amblyopia:	18	24.3	56	34.1	74	31.1	2.29
Yes							0.129
No	56	75.7	108	65.9	164	68.9	
Anisometropia:	29	39.2	37	22.6	66	27.7	7.03
Yes							0.0079*
No	45	60.8	127	77.4	172	72.3	

$\chi^2$  chi square \* significant at P < 0.05.

**Table 4**  
Distribution of different types of refractive disorders in children.

Refractive Error types		Private school 543		Governmental school 532		Total		
		No	%	No	%	No	% of RE types in all RE students (238)	% of RE in all study students (1075)
Myopia	Mild	12	2.2	18	3.4	42	17.6	3.9
	Moderate	3	0.6	9	1.7			
Hyperopia	Mild	5	0.9	17	3.2	34	14.3	3.2
	Moderate	2	0.4	10	1.9			
Astigmatism	Level 1	43	7.9	93	17.5	162	68.1	15.1
	Level 2	9	1.7	17	3.2			
Total		74	13.6	164	30.8	238	100	22.1

$\chi^2 = 2.24$   $p = 0.325$

$\chi^2$  chi square \* significant at  $P < 0.05$ .

#### Declaration of competing interest

There are no conflicts of interest.

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