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Causes of Decreased Visual Acuity in Primary Schools' Students in a Sample of Iraqi Schools

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Abstract: Aim: The goal is to evaluate pupils in elementary schools for visual acuity (VA) to determine factors that contribute to a decline in VA.

Methods: During a 12-month follow-up period between June 2024 and June 2025, a sample of Iraqi primary school students participated in this cross-sectional study. One thousand eight hundred eighty-five pupils were randomly chosen from five elementary schools in Iraq—two in Baqubah (an urban region), three in Kana'an City (a rural location), and five in Diayala. Every student had completed a thorough eye exam at school, which included cover/uncover and alternate cover tests, visual acuity, and ocular motility. Children with cycloplegia, along with subnormal visual acuity (<6\6), were taken to a primary eye care unit for a follow-up examination using an autorefractometer (Huvits HRK-7000) and a posterior and anterior segment examination using a slit lamp and a condensing lens with a diopter of +90. Children having a history of trauma, strabismus, or prior eye surgery were not allowed to participate in the research.

Findings: This study involved 3770 eyeballs from 1885 elementary school pupils. There were 43.4% female participants and 56.6% male participants, with a mean age of 9 years (range: 6–12). One thousand four hundred ninety-seven eyes (39.7%) had aberrant VA when the VA was checked. They were referred to a primary care facility for cycloplegic refraction, and two days later, their VA was checked again. There were 1007 (26.7%) fewer eyes with abnormal VA. It was discovered that the most prevalent cause of decreased vision (98.2%) was refractive errors, with hypermetropia having the greatest occurrence, afterwards astigmatism and myopia.

Conclusion: According to the current study, uncorrected refractive error is the most prevalent cause of decreased visual acuity in school-age children, and the majority of these defects (87.1%) go untreated. The most prevalent mistake was hypermetropia, which was followed by astigmatism along with myopia.

Keywords: Decreased Visual Acuity; Primary Schools; Refractive Error; Astigmatism; And Myopia.

INTRODUCTION

Early school life is a critical period of human growth, a moment when the groundwork for a lifetime of learning, social belonging, and mental maturity is aggressively laid [1]. In this vibrant environment, clarity of vision is not merely a sense experience but a fundamental conduit by which a child comes to encounter, understand, and obtain access to the universe of written language, arithmetic, images, and social cues that comprise their learning world [2]. Visual acuity, or the clarity or sharpness of vision determined by the ability to recognize letters or symbols in a standardized distance, is then a cornerstone of academic success and holistic development [3]. However, a silent but often overlooked epidemic is increasingly prevalent in classrooms globally: declining visual acuity among school-aged children [4]. This is more than a matter of statistical occurrence, but is instead an acute public health problem with profound implications for educational opportunity, mental health, and future economic performance [5]. The significance of this research is underscored by the acrimonious reality that undetected and untreated vision problems can pose as learning disabilities, attention deficit, or just plain laziness in school, leading to misdiagnosis, inappropriate intervention, and an unfortunate cycle of frustration and decreased self-esteem for the handicapped child [6]. Therefore, recognizing the unique etiology of visual deterioration in this group is no solitary ophthalmological endeavor but rather a multidisciplinary necessity that crosses fields with education, pediatrics, social policy, and computer technology. [7]

The prevalence of visual impairment in children around the world is atrocious. The World Health Organization would estimate that there are 19 million children under the age of 15 with visual impairment, and uncorrected refractive errors such as myopia (nearsightedness), hyperopia (farsightedness), and astigmatism are the leading cause and account for a vast majority of them [8,9]. Most unsettling is the acceleration of myopia prevalence, or the "myopia boom," whereby the estimates go toward nearly half of the world's population being myopic by the year 2025, with much of this increase in the younger age groups [10]. Such a trend implies that etiology cannot be purely genetic but is decisively driven by the modern environmental and behavioral alterations. In the isolated world of a first-grade classroom, these global advancements reveal themselves in tangible ways: the squinting student to read the whiteboard, the student who complains of headaches after reading, the student who refuses to perform near work, or the seemingly disconnected student who's lagging academic achievement is purely a result of an inability to clearly read instruction. These are the human faces of diminished visual acuity, and their difficulties focus attention upon the gap between a general classroom's visual demands and the visual capability of more and more of its citizens. [11,12,13]

The etiology of such decline is interdependent and multifactorial and involves a complex causal relationship that is complex, and this study tries to disentangle it in a given sample of schools. They may be categorized broadly into genetic, environmental, and socio-economic determinants [14]. Genetically, a history of refractive error, i.e., particularly myopia, remains an essential non-modifiable risk factor, rendering a child susceptible to similar issues with vision. But genetics cannot explain the sudden increase in cases, and direct irrefutably to highly energetic environmental stimuli. The most obvious of these in the 21st century is the extreme alteration of children's eye use [15]. The modern childhood is more sedentary and indoor than at any other time in history, spent with lengthy blocks of time in front of electronic screens—tablets, smartphones, computers, and TVs—for educational and entertainment purposes. This "near-work" type, typified by prolonged focusing on near targets, has a strong correlation with the development and onset of myopia [16]. Concurrently, concurrent decreases in outdoor activity have been singled out as the critical independent risk factor. Numerous research studies have demonstrated that exposure to light from natural light and the potential to concentrate eyes in the

distance are protective against myopia development, with the probable mechanism being the discharge of dopamine within the retina. [17]

MATERIALS AND METHODS

Study Design

During a 12-month follow-up, this cross-sectional study was conducted in elementary schools with children aged 6 to 12 (mean age was 9 years). There were 1885 children in all, 1067 of them were males (56.6%) and 818 of whom were girls (43.4%). Each student had completed a thorough eye exam at school, which included tests for visual acuity, ocular motility, cover/uncover, and alternative cover (near and distant). Children having subnormal visual acuity (less than 6/6), both with and without cycloplegia, were sent to a primary eye care center for a follow-up examination using an autorefractometer (Huvits HRK-7000). This was followed by an anterior as well as posterior segment examination using a slit lamp and a condensing lens with a diopter of +90.

Data collection and study population selection:

Three randomly chosen schools in the rural region of Kana'an City and two in the urban area of Baqubah comprised the research population, which was gathered from five elementary schools in Iraq-Diayala. Every school was similar in terms of its size, curriculum, extracurricular activities, and student body makeup. All pupils in the chosen schools were evaluated for this cross-sectional study with consent from the parents and the school administration. With the assistance for two teams of qualified and experienced optometrists, data was gathered between October 2017 and April 2018. Snellen's chart was used to test visual acuity (VA) for distance, and a score of 6/6 was considered normal. Cycloplegic eye drops (cyclopentolate 1%) were applied to both eyes in patients with abnormal VA. These drops were reapplied after five minutes and again after thirty minutes. Autorefraction was performed after an additional half-hour of waiting. Those having a visual acuity score for 6/6 without correction were eliminated when the VA was finally rechecked two days later. Children having a history of trauma, strabismus, or prior eye surgery were not allowed to participate in the research. SPSS version 22.0 was used to design and identify all outcomes.

RESULTS

A total of 1885 students were enrolled in this research, with 1067 (56.6%) being males and 818 (43.4%) being girls. They ranged in age from 6 to 12 years, and **Figure 1** shows that the males to girls' ratio was 1.3:1.

Of the 1885 pupils enrolled in school, 775 boys (56.6%) and 542 girls (43.4%) had normal visual acuity. Out of 437 students, 819 of the males' eyes had reduced visual acuity. The total number for eyes with subnormal VA decreased to 497, or 23.3% of all the eyes of male students, following referral to the main eye care facility for a recheck of VA as well as refraction, both with and without the use of cycloplegics. Six hundred seventy-eight eyes in girls have shown a reduction in visual acuity. As seen in **Figure 2**, the number of eyes with subnormal VA decreased to 510 following referral to the main eye care unit to rechecking VA, along with refraction, both with and without the use of cycloplegics. This represents 31.2% of all the eyes of female students.

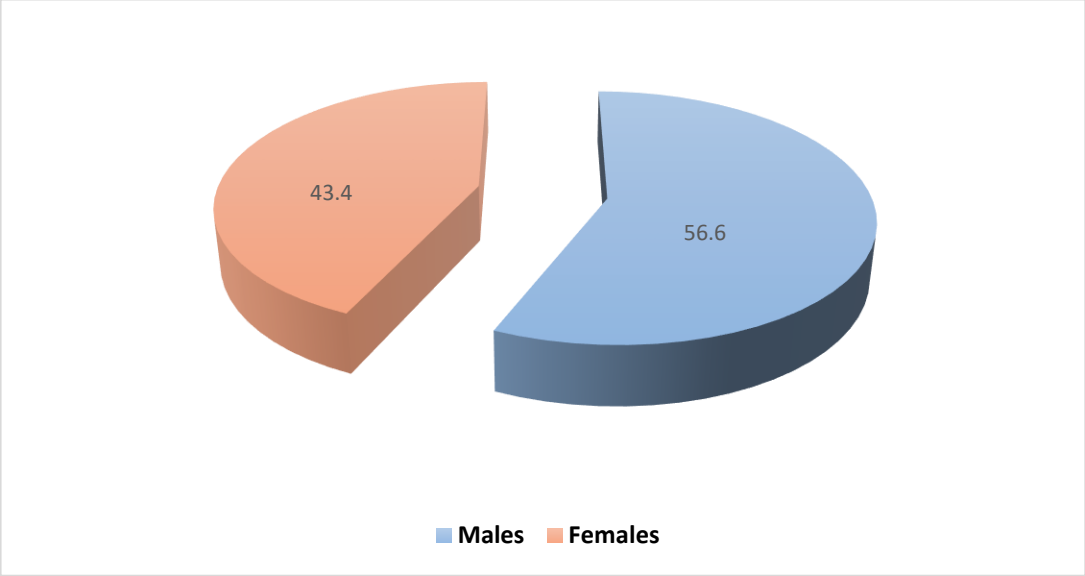

Figure 1: Distribution of study participants by gender.

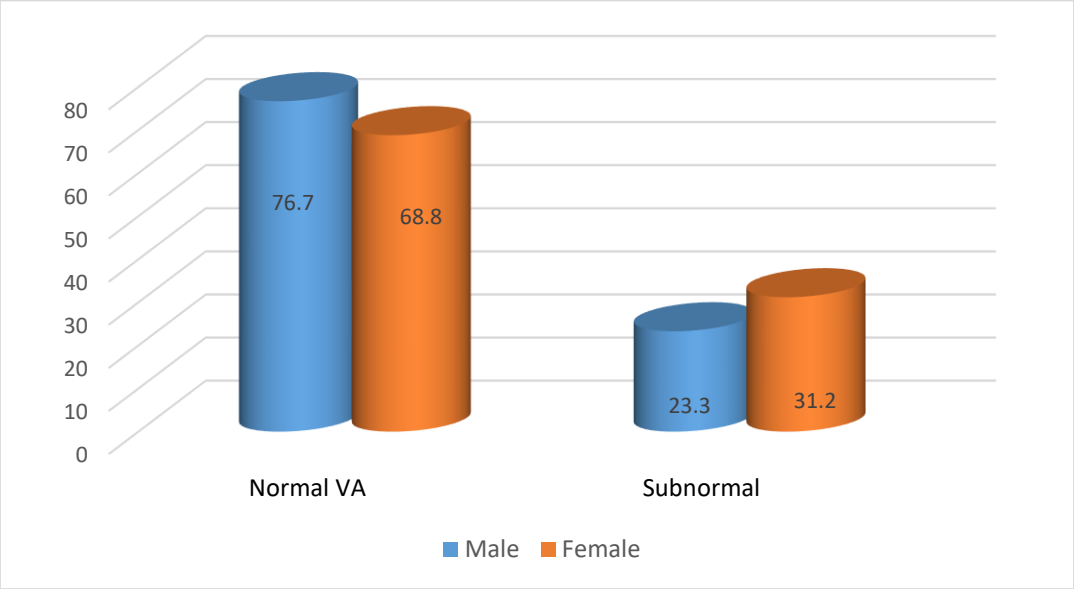

Figure 2: Distribution of study participants by visual acuity.

As indicated in **Table 1**, the largest proportion of subnormal visual acuity was reported by male students in the 6/9 category (60.4%), followed by 6/60 (25.4%), and by female students in the 6/9 category (29.1%), followed by 6/18 (19.4%).

As indicated in **Table 2,** the results for the male group indicated that the primary cause of reduced visual acuity was refractive error, which had been followed by albinism, congenital cataract, retinitis pigmentosa, and aphakia. For the female group, the primary causes of impaired visual acuity were also refractive error, followed by congenital cataract, aphakia, and sclerocornea.

An estimated 87.1% of the pupils in the study group had undiagnosed refractive problems, with 90.5% of males and 83.7% of girls having such issues. According to **Table 3**, among the population under study, previously diagnosed refractive defects were discovered in 9.5% of boys and 16.3% of girls, with an estimated frequency of 12.9%.

Table 1: Subnormal visual acuity according to gender.

Degree of subnormal visual acuity	Gender		
	Boys' eyes (%) n=497	Girls' eyes (%) n= 510	Total eyes (%) n= 1007
6/9	300 (60.4)	148 (29.1)	484 (48.1)
6/12	90 (18.1)	75 (14.7)	165 (16.4)
6/18	63 (12.7)	99 (19.4)	162 (16.1)
6/24	42 (8.4)	56 (10.9)	98 (9.7)
6/36	12 (2.4)	29 (5.7)	41 (4.1)
6/60	126 (25.4)	35 (6.9)	161 (15.9)
C.F.	8 (1.6)	14 (2.7)	22 (2.2)
No L.P	0 (0)	2 (0.4)	2 (0.2)

Table 2: Causes of decreased visual acuity.

Causes of Decreased visual acuity	Gender			Total eyes (%) n= 1007
	Boys' eyes (%) n= 497		Girls' eyes (%) n= 510	
Refractive Error	485 (97.6)		504 (98.8)	989 (98.2)
Albinism	4 (0.8)		0 (0.0)	4 (0.4)
Congenital Cataract	4 (0.8)		2 (0.4)	6 (0.6)
Retinitis Pigmentosa	2 (0.4)		0 (0.0)	2 (0.2)
Aphakia	2 (0.4)		2 (0.4)	4 (0.4)
Sclerocornea	0 (0)		2 (0.4)	2 (0.2)

Table 3: Frequency of undiagnosed and diagnosed refractive errors.

Refractive Errors	Gender			Total eyes (%) n= 989
	Boys' eyes (%) n= 485		Girls' eyes (%) n= 504	
Undiagnosed	439 (90.5)		422 (83.7)	861 (87.1)
Diagnosed	46 (9.5)		82 (16.3)	128 (12.9)

According to **Table 4**, the findings showed that 4.1% of boys, as well as 7.1% of girls who had undetected refractive problems, had amblyopia. According to **Table 5**, the current study's findings showed that hypermetropia was the most common type of refractive error among students, both male and female (37.1% and 67.5%, respectively), followed by astigmatism (45.2% in girls & 26.2% in boys), and myopia (17.7% in girls and 6.3% in boys).

Table 4: Amblyopia in eyes with undiagnosed refractive errors.

Undiagnosed Refractive Error	Gender			Total eyes (%) n= 861
	Boys' eyes (%) n= 439		Girls' eyes (%) n= 422	
Amblyopia	18 (4.1)		30 (7.1)	48 (5.6)

Table 5: Frequency of types of refractive errors.

Type of refractive error	Boys	Girls	Total eyes (%)
Hypermetropia	340 (67.5)	180 (37.1)	520 (52.6)
Myopia	32 (6.3)	86 (17.7)	118 (11.9)
Astigmatism	132 (26.2)	219 (45.2)	351 (35.5)
Total	504 (50.9)	485 (49.1)	989 (100)

DISCUSSION

The sample of 1885 Iraqi elementary school students included both males and girls from both urban and rural areas. Students having a history of strabismus, ocular surgery, or trauma were not allowed to participate in the research. The huge proportion of kids with worse visual acuity who may go undiagnosed or untreated is one of the study's most surprising findings.

In contrast to the 12.8% seen in the Chinese study, 23.3% of men and 31.2% of women in this study reported having reduced visual acuity (6~9 or worse) [18]. Although the study showed agreement with a Chinese study [19] that found 27.0% of students in school present with decreased vision, this can be explained by the various ethnic origins, cultures, and environmental factors, such as accommodative effort related to schooling intensity, influencing the onset and progression for accommodation spasm.

Refractive errors were shown to be the source of decreased visual acuity in 98.2% of both genders. This finding is consistent with findings from an urban research by He M. et al. [20], which found that refractive errors were the cause of diminished vision in 94.9% of the eyes. Refractive error was shown to be the cause of impaired vision in 97.6% all the eyes in the research [21]; however, in other investigations [22,23], it was determined to be 81.8 percent. Research in Nepal [24] had the lowest rate, with 56% of participants having refractive defects.

87.1% of children had undiscovered refractive defects, which is in line with a Nigerian research [25] that reported 90.3% of children had uncorrected refractive flaws in their better eye. This is in contrast to a study conducted in Pakistan [26] that revealed 17.5% of children had undetected refractive errors. Further to the students' mean age of 7 years ±1.7 years, this discrepancy can be explained by the parents' varying educational backgrounds, the amount of data, and the aberrant VA that was determined in their study to be less than 6/12.

The prevalence of amblyopia was 5.6%, which was consistent with an Iranian research [26] that indicated 8.1% of children are at risk for the condition, while an Egyptian study [27] found 1.98%. The research methodology and the overall number of children analyzed may account for this discrepancy.

Myopia is the least prevalent refractive defect in this research, whereas hypermetropia and astigmatism were the most common. Additionally, research [28] indicated that the most prevalent cause was hypermetropia, which followed closely after astigmatism and myopia. It contradicts, however, a study conducted in Pakistan [29] that found that myopia was the most prevalent refractive defect in Lahore, followed by astigmatism and hypermetropia. This discrepancy may be explained by the fact that, in addition to variables like age, race, the method used to test visual acuity (Snellen's, logMar), and whether or not they utilize cycloplegia, the prevalence in refractive defects differs significantly between geographic or racial groups.

CONCLUSIONS

According to the current study, uncorrected refractive error is by far the most prevalent reason of children in schools losing their visual acuity, and the majority of these defects (87.1%) go untreated. The most prevalent mistake was hypermetropia, which was followed by astigmatism along with myopia.

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