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ASSESSMENT OF ANISOMETROPIA IN VISUALLY IMPAIRED CHILDREN AGED 6-14 YEARS IN HO CHI MINH CITY

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ABSTRACT

Objectives: To assess the prevalence and characteristics of anisometropia in children aged 6-14 years with visual impairment in Ho Chi Minh City.

Subjects and methods: A retrospective descriptive study was conducted on 3593 visually impaired children aged 6-14 years in Ho Chi Minh City from August 2023 to October 2023.

Results: The prevalence of anisometropia was 26.30%, with 23.60% showing a refractive difference between 1.00D and 3.00D. The rate of amblyopia was higher in all asymmetric refractions from 1.00D and above. Primary school children had a significantly lower prevalence of anisometropia (18.70%) compared to secondary school children (30.96%). The prevalence of unilateral refractive error was higher than that of bilateral refractive error.

Conclusions: The prevalence of anisometropia in visually impaired children aged 6–14 years in Ho Chi Minh City was 26.30%. There were statistically significant correlations between anisometropia and amblyopia, school level, and the laterality of refractive error.

Keywords: Anisometropia, visual impairment, Ho Chi Minh City.

1. INTRODUCTION

Anisometropia is a visual disorder characterized by an unequal refractive power between the eyes, affecting approximately 10% of the adolescent population [1]. This condition creates a disparity in both size and quality of retinal images between the two eyes. It can manifest in various forms, including asymmetric myopia, hyperopia, astigmatism, or compound refractive errors, and has been closely linked to the development of amblyopia, diplopia, and strabismus [2]. While definitions of anisometropia vary, most researchers consider a difference in spherical equivalent (SE) of 1 diopter or more between the eyes as the diagnostic threshold [3].

The severity of binocular vision impairment correlates with the magnitude of refractive difference between the eyes. Hence, early detection and treatment are essential to prevent permanent vision loss. The spectacle correction in these patients is complex when aiming to achieve optimal visual acuity and comfort. The magnification effect of corrective lenses can create significant disparities in image size between the eyes, leading to discomfort and difficulties in binocular fusion [4]. Although there is no consensus on an ideal age for correction, early intervention is essential for proper visual development and maturation. Even mild anisometropia (<1D) should be corrected to ensure normal vision and prevent complications such as amblyopia and strabismus[5].

Numerous global studies have investigated the prevalence and factors influencing anisometropia. Yamashita et al. (1999) observed a slight increase in the rate of anisometropia from 1.43% at age 6 to 3.14% at age 11 [6]. Tong's study (2006) on children aged 7-11 years showed that refractive asymmetry was significantly higher in myopic children compared to non-myopic children. [7]. While some studies on anisometropia have been conducted in Vietnam, such as Tran Tat Thang's study (2023), they have been limited by small sample sizes [4]. Therefore, we aim to assess the prevalence of anisometropia among visually impaired students aged 6-14 years in Ho Chi Minh City.

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2. SUBJECTS AND METHODOLOGY

2.1. Research subjects

Children aged 6-14 from primary and secondary schools in Ho Chi Minh City were selected to participate in the study.

2.2. Study duration

- Data collection period: August 2023 to October 2023.
- Research period: June 2024 to October 2024.

2.3. Methods

- Study design: A descriptive, retrospective case series.
- Sample size and eligibility criteria:

The study sample size was calculated using the World Health Organization formula for estimating a proportion in the population.

$$n = \frac{Z^2_{1-\alpha/2}\, p(1-p)}{d^2} \times \text{Number of schools} \times \text{Design effect}$$

Anisometropia prevalence (≥1.00D): p = 21%, according to Tran Tat Thang et al. (2023) [4]; number of schools: 11; design effect: 1.

The calculated minimum sample size was 2,805. The actual study included 3,593 children aged 6-14 years who met the inclusion criteria and had no exclusion criteria.

Sampling method: convenience sampling.

- Eligibility criteria

Inclusion criteria:

+ Students aged 6 to 14;

+ Students who cooperate during the examination;

+ Uncorrected visual acuity of 20/30 or worse in at least one eye.

Exclusion criteria:

+ Children with physical ocular abnormalities (congenital ptosis, congenital strabismus, or other diseases affecting visual acuity aside from refractive errors);

+ Children with severe systemic diseases or acute ocular conditions.

2.4. Data collection

- Collect necessary information, including name, age, gender, medical history, and other relevant conditions if present.
- Evaluate uncorrected visual acuity using the Snellen Chart at 20 feet (equivalent to 6 meters) and recording results in decimal format. Participants with uncorrected visual acuity of 20/30 or worse in at least one eye were included in the study.
- Measure refractive error using an autorefractor.
- Perform subjective refraction and retinoscopy.
- Record best corrected visual acuity with subjective refraction.
- Classify visual acuity according to the World Health Organization (WHO) classification.
- Anisometropia by dividing it into four groups:

+ Anisometropia <1.00D

+ Anisometropia 1.00D to 3.00D

+ Anisometropia >3.00D to 5.00D

+ Anisometropia >5.00D

2.5. Data analysis

Data were analyzed using Excel 2016 and SPSS 22.0. Descriptive statistics included frequencies and percentages for qualitative data. Chi-square tests were used to compare proportions.

2.6. Ethics

All collected data were confidential and used exclusively for research purposes. The authors declare no conflicts of interest.

3. RESULTS

3.1. Demographic characteristics

Table 1. Participant demographics

Characteristics		Quantity (n)	Percentage (%)
Age (years)	6-10	1364	37.96
	11-14	2229	62.04
Gender	Male	1661	46.23
	Female	1932	53.77

The study population comprised 3,593 students (7,186 eyes) aged 6-14 years from primary and secondary schools in Ho Chi Minh City. The mean age was 10.60 ± 2.03 years.

The gender distribution showed a slightly higher proportion of female participants (53.77%) than of males (46.23%), though this difference was not statistically significant.

3.2. Prevalence and classification of Anisometropia

Table 2. Classification of anisometropia

Magnitude of Anisometropia	Quantity (n)	Percentage (%)
<1.00D	2648	73.70
1.00D – 3.00D	848	23.60
>3.00D – 5.00D	70	1.95
>5.00D	27	0.75
Total	3593	100.00

Among 3593 students with visual impairment, the overall prevalence of anisometropia was 26.30%. The highest proportion was anisometropia from 1.00D to 3.00D at 23.60%, followed by anisometropia from 3.00D to 5.00D at 1.95%, and the lowest proportion was anisometropia greater than 5.00D at 0.75%.

3.3. Associations between Anisometropia and Clinical Variables

Table 3. Association between Anisometropia Magnitude and Amblyopia

Amplyopia status				
Magnitude of Anisometropia				p
<1.00D	1.00D – 3.00D	>3.00D – 5.00D	>5.00D	
Non-amblyopic				< 0.001
3245 (76.41%)	910 (21.43%)	64 (1.51%)	28 (0.66%)	
Amblyopic				
2051 (69.79%)	786 (26.74%)	76 (2.59%)	26 (0.88%)	

A significant association was observed between the magnitude of anisometropia and amblyopia (p<0.001). The prevalence of amblyopia was consistently higher in subjects with anisometropia ≥1.00D.

Table 4. Correlation between the degree of anisometropia and the level of education

Education level				
Magnitude of Anisometropia				p
<1.00D	1.00D – 3.00D	> 3.00D – 5.00D	> 5.00D	
Primary school				< 0.001
2218 (81.30%)	456 (16.72%)	32 (1.17%)	22 (0.81%)	
Secondary school				
3078 (69.04%)	1240 (27.82%)	108 (2.42%)	32 (0.72%)	

Children in primary school had a significantly lower rate of anisometropia (18.70%) than those in secondary school (30.96%) (p<0.001).

Table 5. Association between Anisometropia Magnitude and Laterality of Refractive Error

Laterality of refractive error				
Magnitude of Anisometropia				p
<1.00D	1.00D – 3.00D	> 3.00D – 5.00D	> 5.00D	
Unilateral				< 0.001
406 (56.23%)	274 (37.95%)	34 (4.71%)	8 (1.11%)	
Bilateral				
4746 (75.09%)	1422 (22.50%)	106 (1.68%)	46 (0.73%)	

There was a statistically significant correlation (p<0.001) between the degree of anisometropia and the number of eyes with refractive error. The proportion of children with unilateral refractive error was higher than the proportion of children with bilateral refractive error at all asymmetric refractions of 1.00D or more.

4. DISCUSSION

4.1. Demographic characteristics

Our research was conducted on 3593 children aged 6-14 years in Ho Chi Minh City, with a gender distribution of 53.77% female and 46.23% male participants. His distribution aligns with Tran Tat Thang et al.'s findings (2023), which reported similar gender proportions (57% female, 43% male) among patients with refractive errors at Nghe An Eye Hospital [4]. The higher prevalence among females may be attributed to behavioral factors, including increased near-work activities and reduced outdoor exposure [4].

4.2. Prevalence and classification of Anisometropia

In a total of 3593 students with visual impairment, we recorded a high rate of anisometropia with 26.30%, of which: the highest proportion was anisometropia from 1.00D to 3.00D with 23.60%, the anisometropia from more than 3.00D to 5.00D accounted for 1.95%, the lowest proportion was anisometropia greater than 5.00D with 0.75 These findings correspond with Tran Tat Thang et al.'s study reporting 21% prevalence, with 18% mild to moderate and 3% severe cases [4]. Another study on 1979 children from 7 to 9 years old, and not excluding children without refractive error, by Tong in Singapore, showed that the rate of anisometropia was 3.6% [7]. Barrett's systematic study found that the proportion of anisometropia was usually 1/3 compared to the proportion of refractive error in the same age group [8].

4.3. Associations between Anisometropia and Clinical Variables

A significant association was observed between anisometropia magnitude and amblyopia (p<0.001), with higher amblyopia rates across all anisometropia categories ≥1.00D. This aligns with previous research demonstrating elevated amblyopia rates (61.11%) in subjects with anisometropia >1D compared to those with <1D (5.06%) [9]. Nguyen Duc Anh's study at Hanoi Eye Hospital, examining children with refractive errors, found that anisometropia was the leading factor associated with amblyopia (54.4%). The group of anisometropia with one emmetropic eye or a mild refractive error eye was not detected early, leading to amblyopia, especially anisometropia in myopes [10]. Therefore, early detection and regular monitoring of refractive errors in children is essential for optimal management and prevention of amblyopia.

Primary school children in this study had a lower anisometropia (18.70%) than secondary school children (30.96%) (p<0.001). While Tran Tat Thang et al. found no significant age-related differences[4], several longitudinal studies suggest increasing prevalence and magnitude of anisometropia with age, correlating with myopic progression and potentially reflecting insufficient

compensatory mechanisms for maintaining symmetrical ocular development [7], [11].

Unilateral refractive error was significantly associated with higher rates of anisometropia compared to bilateral cases ($p<0.001$). This finding is consistent with the observation of Tran Tat Thang et al., who reported a 42.56% prevalence of anisometropia in cases with unilateral emmetropia [4]. Maintaining functional vision through the unaffected eye may delay detection and intervention, potentially increasing the risk of amblyopia in the affected eye. These cases require special attention to avoid missed diagnoses, as the condition can easily progress to amblyopia in the eye with refractive error.

5. CONCLUSIONS

The study showed that the prevalence of anisometropia in students aged 6-14 years with visual impairment in Ho Chi Minh City was 26.30%. Significant associations were observed between anisometropia and amblyopia, educational level, and refractive error laterality ($p < 0.001$).

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