THE STATUS-QUO OF MYOPIA AMONG HIGH SCHOOL PUPILS AT THANH OAI B HIGH SCHOOL, THANH OAI DISTRICT, HANOI, 2023

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Abstract

Objective: *To describe the status-quo of school myopia among pupils at Thanh Oai B High School, Thanh Oai District, Hanoi, in 2023.*

Methods:

- Subjects: 425 students grades 10 to 12 at Thanh Oai B High School, Thanh Oai District, Hanoi, during the 2022-2023 academic year.

- Study Design: A cross-sectional descriptive study.

Results: *The proportion of myopia among students at Thanh Oai B High School during the 2022–2023 academic year accounted for 46.4%. The incidence was notably higher in female students (53.4%) compared to male counterparts (34.4%). The distribution of myopia severity included mild (66.5%), moderate (29.9%), and severe (3.6%) cases. Among students diagnosed with myopia, 97.9% had undergone vision assessments and were provided with corrective lenses.*

Conclusion: *This study reveals a high incident rate of myopia (46.4%) among students at Thanh Oai B High School, highlighting the need for targeted interventions and preventive measures.*

Keywords: *School myopia school, refractive error.*

Thực trạng cận thị ở học sinh Trường Trung học phổ thông Thanh Oai B, huyện Thanh Oai, Hà Nội năm 2023

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Tóm tắt

Mục tiêu: *Mô tả thực trạng cận thị học đường ở học sinh Trường Trung học phổ thông (THPT) Thanh Oai B, huyện Thanh Oai, Hà Nội năm 2023.*

Đối tượng và phương pháp:

- 425 học sinh từ khối 10 đến khối 12 của Trường THPT Thanh Oai B, huyện Thanh Oai, Hà Nội năm học 2022-2023.

- Thiết kế nghiên cứu mô tả cắt ngang.

Kết quả: *Tỷ lệ cận thị của học sinh tại Trường THPT Thanh Oai B, huyện Thanh Oai, Hà Nội năm học 2022-2023 là 46,4%. Trong đó, học sinh nữ (53,4%), cao hơn nam (34,4%). Tỷ lệ cận thị nhẹ chiếm 66,5%; trung bình 29,9% và nặng 3,6%. Trong số đối tượng cận thị, có 97,9% đã khám và lựa chọn kính đeo phù hợp.*

Kết luận: *Nghiên cứu này cho thấy tỷ lệ cận thị của học sinh Trường THPT Thanh Oai B, huyện Thanh Oai, Hà Nội năm học 2022-2023 khá cao, chiếm tới 46,4 %.*

Từ khóa: *Cận thị học đường, tật khúc xạ.*

1. Introduction

Myopia is a common refractive error, especially among school-aged children. It is characterized by excessive focusing power on relation to the axial length of the eye, leading to light focusing in front of the retina and resulting in blurred vision. The rising prevalence of myopia can be attributed to societal changes and lifestyle habits, such as prolonged reading and extensive screen time [1]. This condition adversely impacts quality of life, particularly in children, and can hinder both health and academic performance. According to the WHO's 2019 "World Report on Vision," over 2.2 billion people worldwide suffer from vision impairment, with over 1 billion cases being preventable [2]. The incident rate of myopia varies by region, with relatively low rates in Africa and significantly higher rates observed in Asia

The increase in myopia can be attributed to a combination of genetic, environmental and behavioral factors. Notably, excessive exposure to screens and working at close distances, which significantly contribute to vision deterioration, with studies indicating a potential 90% loss of vision associated with screen use exceeding three hours per day. Research indicates that the high prevalence of refractive errors, particularly myopia, among school children is attributed not only to genetic factors but also to environmental and nutritional influences [2]. Additionally, environmental factors significantly contribute to the rising prevalence of myopia in East Asia. Vietnam, in particular, has a high rate of myopia, which is rapidly increasing. Although school myopia has been recognized since the 1960s, it remains prevalent and is on the rise in both urban and rural areas. Research by Tran Duc Nghia in primary schools in Dien Bien City revealed a myopia rate of 17.2%, showing a gradual increase from 10.3% in grade 1 to 26.7% in grade 5 [3]. In high school, a study by Nghiem Thi Hoai Thanh found that the prevalence of school myopia reached 51.6% [4]. Thanh Oai B High School, Thanh Oai District, Hanoi with a total of 1,727 students in the 2022-2023 academic year. To contribute to the care and protection of students' health, we conducted a research on the topic ***"The status-quo of myopia in pupils at Thanh Oai B High School, Thanh Oai District, Hanoi in 2023"*** with the objective of describing the current status of school myopia in students at Thanh Oai B High School, Thanh Oai District, Hanoi in 2023.

2. Objects and research methods

2.1. Study Subjects

Pupils grades 10 to 12 at Thanh Oai B High School, Thanh Oai District, Hanoi, in the 2022-2023 academic year.

Inclusion criteria:

- Pupils in grades 10, 11, and 12 at the time of the study.
- Pupils who voluntarily agreed to participate in the study.

Exclusion criteria:

- Pupils who were absent due to illness, leave, or other reasons during the study period.
- Pupils who did not voluntarily consent to participate in the study.

2.2. Research Methods

2.2.1. Study Design

Cross-sectional descriptive study combined with retrospective data on visual acuity measurements of the subjects based on periodic health check-up records.

2.2.2. Sample Size and Sampling Method

Sample size: The sample size was calculated using the formula for estimating a proportion in a descriptive study:

$$n = Z^2_{1-\alpha/2}\,\frac{p(1-p)}{d^2}$$

Where:

- n is the minimum sample size required for the study,
- $Z(1-\alpha/2)$ is the confidence coefficient. For a 95% confidence level ($\alpha=0.05$, $Z(1-\alpha/2)=1.96$
- p is the estimated proportion of subjects with school myopia, taken as p=0.51 ([4]),
- d is the absolute margin of error, set at d=0.05.

Substituting these values into the formula, the minimum sample size required for the study was calculated to be n=385. An additional 10% contingency was added, bringing the total required sample size to 425 students.

Sampling Method: Given the significant disparity in the number of students across the different grade levels, a stratified sampling method was employed to ensure the sample adequately represents the population.

The sample size for each grade level was determined using the following formula:

$$n_i = n\frac{Ni}{N}$$

Where:

- n_i is the sample size for each grade,
- Ni is the number of students in each grade,
- N is the total number of students in the school.

Table 2.1. Sample Size by Grade Level

Grade Level	Total Number of Pupils	Sample Size
Grade 10	670	165
Grade 11	678	167
Grade 12	378	93
Total	1726	425

The students were selected from each grade using a systematic random sampling method.

- A complete list of all students enrolled in grades 10, 11, and 12 at Thanh Oai B High School was compiled.

- The sampling interval (k) was calculated for each grade k = N/n = 1726/425= 4

- With k=4 for all three grades, we randomly selected one student (i) from each grade's list, and then selected every fourth student (i + k, i + 2k, i + 3k, etc.) until the required number of participants for each grade level was reached.

2.2.3. Data Analysis and Processing

Data entry was performed using EpiData 3.1 software. After data entry and validation, the dataset was transferred to SPSS for management and statistical analysis. The following medical statistical methods were employed:

- For quantitative variables: Mean, standard deviation, minimum and maximum values.

- For categorical variables: Frequency and percentage distribution. The data were presented in tables and graphical charts for clarity. The Chi-square test was used for testing associations between categorical variables, with a significance level of $p<0.05$.

Table 3.1. Distribution of Study Subjects by Grade Level (n=425)

Grade Level	Number of Pupils	Percentage (%)
Grade 10	165	38.8
Grade 11	167	39.3
Grade 12	93	21.9
Total	**425**	**100**

Highlights: Among the 425 study subjects, Grade 12 had the lowest proportion at 21.9%. Grades 10 and 11 had nearly identical proportions, accounting for 38.8% and 39.3% of the total sample, respectively.

Table 3.2. Educational Level of Fathers of Study Participants (n=425)

Educational Level	Number	Percentage (%)
Primary school	15	3.5
Secondary school (middle)	112	26.4
High school	188	44.2
Vocational/College	60	14.1
University/Postgraduate	50	11.8

Highlights: The most common educational levels of fathers were high school (44.2%) and secondary school (26.4%). The proportion of fathers with only a primary school education was the lowest, at 3.5%.

Table 3.3. Occupation of Fathers of Study Participants (n=425)

Occupation	Number	Percentage (%)
Farming	179	42.1
Worker	84	19.8
Business	60	14.1
Civil servant/Employee	31	7.3
Other	71	16.7

Highlights: The majority of fathers were engaged in farming (42.1%), while civil servants/ employees accounted for the smallest proportion (7.3%).

Table 3.4. Educational Level of Mothers of Study Participants (n=425)

Educational Level	Number	Percentage (%)
Primary school	12	2.8
Secondary school (middle)	106	24.9
High school	192	45.2
Vocational/College	57	13.5
University/Postgraduate	58	13.6

Highlights: The most common educational levels of mothers were high school (45.2%) and secondary school (24.9%). Over 13% of mothers had vocational/college or university education.

Table 3.5. Occupation of Mothers of Study Participants (n=425)

Occupation	Number	Percentage (%)
Farming	172	40.5
Worker	45	10.6
Business	105	24.7
Civil servant/Employee	42	9.9
Other	61	14.3

Highlights: The majority of mothers were involved in farming (40.5%), while 24.7% of mothers had a business occupation. The smallest proportion of mothers worked as civil servants/ employees (9.9%).

Table 3.6. Average Sleep Duration of Study Participants (n=425)

Sleep Duration	Number	Percentage (%)
≤ 6 hours	93	21.9
> 6 to < 8 hours	254	59.8
≥ 8 hours	78	18.3

Highlights: The majority of participants slept between 6 and 8 hours per day (59.8%), while 18.3% slept 8 hours or more daily.

Table 3.7. Average Sleep Duration of Study Participants (n=425)

Usage Status	Number	Percentage (%)
Time spent using device	> 1 hour	371
	≤ 1 hour	13
	Do not use	41
Distance to the eye	< 25 cm	167
	> 25 cm	217

Highlights: The highest proportion of participants used their phones or computers for over 1 hour per day (87.3%). Only 9.6% of participants did not use a phone or computer.

Table 3.8. TV Viewing and Gaming Habits of Study Participants (n=425)

TV Viewing and Gaming Status	Number	Percentage (%)
Time spent watching TV	> 1 hour	227
	≤ 1 hour	87
	Do not use	111
Time spent playing games	> 1 hour	103
	≤ 1 hour	160
	Do not play	162

Highlights: The proportion of participants watching TV for more than 1 hour per day was 53.4%, while 26.1% did not watch TV.

Table 3.9. Study Participants' Study Area Conditions at Home (n=425)

Home Study Area Conditions	Number	Percentage (%)
Has a designated study area	No	92
	Yes	333
Lighting conditions at study area	Poor	71
	Adequate	354
Type of study light color	White light	291
	Yellow light	42

Highlights: The majority of participants (78.4%) had a designated study area at home. Of those, 87.4% used white light in their study lamps, while 12.6% used yellow light. Additionally, 16.7% studied in areas with insufficient lighting.

Table 3.10. Classroom Seating Conditions of Study Participants (n=425)

Classroom Seating Conditions	Number	Percentage (%)
Lighting conditions at seating	Poor	64
	Adequate	361
Glare from the board	Often	63
	Occasionally	203
	None	159
Regular seat changes	No	109
	Yes	316

Highlights: 15.1% of participants reported inadequate lighting at their classroom seating. The proportion of participants experiencing frequent glare from the board was 14.8%, while 47.8% experienced occasional glare. Additionally, 25.6% of participants reported no regular changes in their seating arrangement.

3.2. Current Status of Myopia in Study Participants

Table 3.11. Distribution of Myopia by Gender in Study Participants (n=425)

Gender	Myopia (n)	Myopia (%)	No Myopia (n)	No Myopia (%)
Male	54	34.4	103	65.6
Female	143	53.4	125	46.6
Total	**197**	**46.4**	**228**	**53.6**

Highlights: The prevalence of myopia was higher among females (53.4%) compared to males (34.4%).

Table 3.12. Distribution of Myopia by Grade Level in Study Participants (n=425)

Grade Level	Myopia (n)	Myopia (%)	No Myopia (n)	No Myopia (%)
Grade 10	71	43.0	94	57.0
Grade 11	80	47.9	87	52.1
Grade 12	46	49.5	47	50.5
Total	**197**	**46.4**	**228**	**53.6**

Highlights: The highest prevalence of myopia was observed in Grade 12 (49.5%), while the lowest was in Grade 10 (43%).

Table 3.13. Distribution of Myopia by Genetic Factors in Study Participants (n=425)

Genetic Factor	Myopia (n)	Myopia (%)	No Myopia (n)	No Myopia (%)
Parent(s) with myopia	13	52.0	12	48.0
No parent with myopia	184	46.0	216	54.0
Total	**197**	**46.4**	**228**	**53.6**

Highlights: Participants with a family history of myopia had a higher prevalence of myopia (52%) compared to those without such a history (46%).

Table 3.14. Distribution of Myopia by Age of Onset in Study Participants (n=197)

Age of Onset	Number	Percentage (%)
Newborn – under 6 years	3	1.5
6 – 11 years	57	28.9
12 – 15 years	108	54.8
≥ 16 years	29	14.8
Total	**197**	**100**

Highlights: The majority of myopia cases were detected between the ages of 12 and 15 years (54.8%), which corresponds with the secondary school period. Only 1.5% of participants had myopia detected at birth or before the age of 6.

Table 3.15. Distribution of Myopia Among Participants Using Glasses (n=197)

Glasses Usage	Number	Percentage (%)
Wears glasses	193	97.9
Does not wear glasses	4	2.1
Total	**197**	**100**

Highlights: Among the 197 myopic participants, 97.9% wore glasses, and only 2.1% did not.

Table 3.16. Distribution of Reasons for Wearing Glasses in Study Participants (n=193)

Reason for Wearing Glasses	Number	Percentage (%)
Myopia	159	82.4
Myopia and astigmatism	34	17.6
Total	**193**	**100**

Highlights: Among the participants wearing glasses, 17.6% had both myopia and astigmatism, while 82.4% only had myopia.

Table 3.17. Degree of Myopia in Study Participants (n=197)

Degree of Myopia (Diopters)	Right Eye (n)	Right Eye (%)	Left Eye (n)	Left Eye (%)
-0.25 to -3.00 Diopters	131	66.5	131	66.5
-3.25 to -6.00 Diopters	59	29.9	58	29.4
≥ -6.25 Diopters	7	3.6	8	4.1
Total	**197**	**100**	**197**	**100**

Highlights: The majority of participants had mild myopia, with a refractive error between -0.25 and -3.00 diopters (66.5%). Only 4.1% had severe myopia (≥ -6.25 diopters).

Table 3.18. Distribution of Physical Activity and Outdoor Engagement

Outdoor Activity Participation	Myopia (n)	Myopia (%)	No Myopia (n)	No Myopia (%)
Engaged in outdoor activities	181	46.4	209	53.6
Not engaged	16	45.7	19	54.3
Total	**197**	**46.4**	**228**	**53.6**

Highlights: The prevalence of myopia was similar between participants who engaged in outdoor activities (46.4%) and those who did not (45.7%).

4. Discussion

Our research results show that the prevalence of myopia in female subjects is 53.4%, significantly higher than in male subjects (34.4%). These findings differ from those of other studies, such as the one by Nguyen Thi Ha Phuong, where the prevalence of myopia in female students was only slightly higher than in male students (27.1% compared to 26.7%) [5]. Research by Tran Tat Thang found that 50% to 53% of female students were affected by myopia, while the rate in male students ranged from 47% to 50% [6]. However, our results are consistent with those of other studies, such as the one by Do Thi Phuong, which reported a myopia rate of 46.2% in female students and 36.4% in male students, with the difference being statistically significant ($p < 0.05$) [7]. To explain the higher prevalence of myopia in females compared to males, numerous studies have provided valid explanations. According to research by Xiaoran Liu at the University of Massachusetts Medical School, estrogen may increase the risk of myopia. Estrogen can boost the production of a protein called fibroblast growth factor 8 (FGF8) in the eye, which is involved in lens development. Increased FGF8 production can lead to a longer lens, resulting in myopia [8]. Additionally, males tend to engage in more outdoor activities than females, which helps reduce the risk of myopia.

Our study found that the prevalence of myopia was 43.0% in grade 10, 47.9% in grade 11, and 49.5% in grade 12. The overall rate of myopia across all three grades was 46.4%. This finding is consistent with recent studies, such as that by Nguyen Thi Huyen, which reported an average myopia rate of 35% in Vietnamese high school students, with female students being about 10% more likely to develop myopia than male students [9]. The results of Nghiem Thi Hoai Thanh indicated a 51.6% myopia rate in high school students, with the highest prevalence in grade 12 (34.6%) and the lowest in grade 11 (32.2%) [4]. Our study shows a higher prevalence than the study by Nguyen Thi Hong Diem, which found a general myopia rate of only 28.4% among high school students, with individual grade rates ranging from 26% to 35% [11]. The increasing rate of myopia in students

may be attributed to long hours spent studying and using electronic devices, especially during online learning in the COVID-19 pandemic. Poor lifestyle habits such as staying up late and inadequate nutrition may also negatively impact eye health.

Our results also show that students with myopic parents have a higher prevalence of myopia compared to those whose parents are not myopic. Specifically, the myopia rate in students with myopic parents was 52.0%, compared to 46% in students with non-myopic parents. This finding is consistent with studies from around the world that indicate myopia has a hereditary component. The prevalence of myopia is higher in individuals with myopic parents. For example, a study by Christopher G. Jones found that individuals with myopic parents were 20% more likely to have myopia than those without myopic parents (50% compared to 20%) [12]. Another study by Vikram Handa showed a myopia rate of 40% in individuals with myopic parents, compared to 30.7% in those without myopic parents [13].

Our study (Table 3.14) found that 30.4% of myopia cases were detected in students under 12 years old, 54.8% in students aged 12 to 15 years, and 14.8% in students aged 16 and older. This finding aligns with global research, which shows that myopia typically begins to develop in children between 6 and 8 years old and increases with age [14]. A study by Jason C. Yam (2020) in Hong Kong found that the myopia rate in children aged 6 to 8 years was 20%, while the rate in adolescents aged 16 to 18 years was 50% [15].

Our study also found that the rate of myopia combined with astigmatism in students at Thanh Oai B High School, Hanoi, was 17.6%, which is consistent with the findings of other published studies. For example, Nguyen Thi Huyen reported a 16.2% rate of students with both myopia and astigmatism [11]. Furthermore, our research revealed that only 2.1% of myopic students did not wear glasses. This is a positive outcome, indicating greater awareness of eye health care among students and parents. Our results show that 66.5% of students had myopia between 0.25 and 3.00 diopters, a mild level that does not significantly affect vision. However, these students still need to wear glasses to ensure optimal vision. The study also found that 29.9% of students had myopia between 3.25 and 6.00 diopters, which is a moderate level that can affect vision. These students should wear glasses regularly to maintain the best vision. Finally, 3.6% of students had myopia of 6.25 diopters or more, which is considered severe myopia and can significantly impair vision. These students should wear glasses consistently, have regular eye exams, and consult an ophthalmologist for appropriate treatment.

5. Conclusion

The rate of myopia among students at Thanh Oai B High School, Hanoi is quite high, accounting for 46.4%. In which: female students (53.4%) are higher than male students (34.4%). The rate of myopia is relatively even in the three grades and is the highest in grade 12 (49.5%). The rate of mild myopia is 66.5%; moderate myopia is 29.9% and severe myopia is 3.6%. Among the myopia subjects, 97.9% have been examined and selected suitable glasses, the subjects who have not used glasses account for 2.1%.

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