



# The Prevalence of Myopia among School Students in Urban Area Bangladesh and to Explore the Associations between Reading and Writing Postures and Myopia

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Background:** Myopia, often known as near-sightedness, is a common visual issue that typically first appears between the ages of 6 and 14. Roughly 5% of toddlers, 9% of elementary schoolchildren, and 30% of high schoolers are affected. Having near-sighted parents increases a child's risk of developing myopia.

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**Objective:** To assess the prevalence of myopia among school students in urban area Bangladesh and to explore the associations between reading and writing postures and myopia.

**Methodology:** A complicated, stratified, multistage sample design was used to select the participants from January 2019 to January 2020. Using a random number generator, we chose one urban region and one rural area in Bangladesh, and at least 50 students from each grade in elementary, middle, and high school participated in the studies. Students from elementary school (n=50), middle school (n=50), and high school (n=50) were all included in our study, which included a total of 150 participants.

**Results:** During the study, mean age of the patients was  $10.50 \pm 0.86$  years. Followed by middle school group mean age was  $14.09 \pm 0.92$  years and high school group was  $16.55 \pm 0.89$ . Plus majority were male. In primary school group 35% cases usually had their chest is more than the width of a fist from the edge of the table. Followed by in middle school group it was 25% and in high school group it was 27%. Plus, in primary school group 26% had usually eyes are more than 33 cm (one Chi) away from the book followed by in middle school group it was 30% and 31%. Regarding the associations between reading and writing postures and myopia, we identified that a reading distance  $>33$  cm is a protective factor for myopia in female students [odds ratio (OR) = 0.31, 95% confidence interval (CI) = 0.15–0.64], in both primary school (OR = 0.55, 95% CI = 0.30–0.99) and middle school (OR = 0.37, 95% CI = 0.15–0.90)

**Conclusion:** A reading distance  $>33$  cm can be used as an additional measure to prevent and control myopia. Proper postural measures for reading and writing may have educational and public health benefits.

*Keywords: Reading and writing posture; myopia; school students.*

## 1. INTRODUCTION

Myopia in children and teenagers has emerged as a serious issue in recent decades [1]. Aside from heredity [2], myopia in children and adolescents is also influenced by variables such as educational attainment and school accomplishment [3], the quantity of near work performed [4], body stature [5], the degree of urbanization [6], and the amount of outdoor activity participated in [7].

To combat myopia, researchers are examining and trying to alter environmental variables. One of the main targets of treatment is the near vision behavior associated with poor reading and writing posture [8]. According to the "one Chi, one fist, and one Cun" principle (Chi and Cun are units of measurement in ancient China, one Chi = 33 cm, one Cun = 3.3 cm, and one fist is the width of a fist), the distance between a child's eyes and a book should be about 33 cm, the distance between a child's chest and a desk should be about the width of a fist, and the distance between a child's eyes and a book should be about the width of a fist. The "three ones" idea is the basis for practically all standards for reading and writing postures in underdeveloped nations like Bangladesh. A small number of studies used none of the aforementioned criteria, while others modified or added to them [9].

The most frequent reference point is the distance between the reader's eyes and the page, with 30–33 cm being the norm. Reading and writing distance, short-distance reading time, assessing if the body is sitting erect, and identifying forward or backward skew are some of the other measures most commonly used in academic research.

### 1.1 Objective

To assess the prevalence of myopia among school students in urban area Bangladesh and to explore the associations between reading and writing postures and myopia.

## 2. METHODOLOGY

Myopia was linked to poor reading and writing postures in a cross-sectional survey of the Bangladeshi population which was carried from January 2019 to January 2020.

A complicated, stratified, multistage sample design was used to select the participants. Using a random number generator, we chose one urban region and one rural area in Bangladesh, and then randomly selected seven schools (two elementary schools, two middle schools, two high schools, and one vocational high school) in the urban region and five schools (two

elementary schools, two middle schools, and one high school) in rural area.

At least 50 students from each grade in elementary, middle, and high school participated in the studies. Students from elementary school (n=50), middle school (n=50), and high school (n=50) were all included in our study, which included a total of 150 participants.

### 3. RESULTS

Table 1 shows demographic status of the patients where in primary school group, mean age of the patients was 10.50± 0.86 years. Followed by middle school group mean age was 14.09 ± 0.92 years and high school group was 16.55 ± 0.89.

Fig. 1 shows gender distribution where in all group majority were male.

Fig. 2 shows Myopia prevalence according to gender where The prevalence of myopia among primary school students was 55%% for male students and 66% for female students. The prevalence of myopia among middle school students was 77%for male students and 78% for female students. The prevalence of myopia among high school students was 79% for male students and 82% for female students.

Table 2 shows clinical history of the patients where in primary school group 35% cases usually had their chest is more than the width of a fist from the edge of the table. Followed by in middle school group it was 25% and in high school group it was 27%. Plus, in primary school group 26% had usually eyes are more than 33 cm (one Chi) away from the book followed by in middle school group it was 30% and 31%.

Table 3 shows Logistic regression of myopia-related factors by gender where after adjusting for age and grade, a reading distance of more than 33 cm was identified as a protective factor for myopia in female students. The higher the frequency of the reading distance more than 33 cm, the lower the risk of students getting myopic. Compared with female students who chose “never” for “the eyes are more than 33 cm away

from the book,” the odds ratio (ORs) and 95% confidence intervals (CIs) for subjects who chose “sometimes,” “usually,” and “always” were 0.52 (0.28, 0.97), 0.49 (0.25, 0.96), and 0.31 (0.15, 0.64), respectively. In male students, keeping the finger 3.3 cm away from the nose tip was also found to be a protective factor. Compared with male students who chose “never” for “the finger is about 3.3 cm away from the tip of the nose,” the OR and 95% CI for subjects who chose “sometimes” were 0.61 (0.39, 0.96). However, keeping the chest more than the width of a fist away from the edge of the table was a risk factor for myopia in female students [usually: 1.89 (1.03, 3.49), always: 2.01 (1.04, 3.88)]. In both male and female students, the more the parents reminded them of their reading and writing postures, the higher the risk of getting myopia.

Table 4 shows Logistic regression of myopia-related factors by school type where After adjusting for gender and age, reading distances more than 33 cm were identified as a protective factor for myopia in both primary [always: 0.55 (0.30, 0.99)] and middle school students [always: 0.37 (0.15, 0.90)]. Compared with middle school students who chose “never” for “the finger is about 3.3 cm away from the tip of the nose,” the OR and 95% CI for subjects who chose “sometimes” was 0.41 (0.21, 0.79). Still, keeping the chest more than the width of the fist away from the edge of the table was a risk factor in middle school students, and parents who were reminded of reading and writing postures were considered a risk factor in primary school students.

### 4. DISCUSSION

Our study's prevalence of myopia among Chinese schoolchildren was in line with that found in other regions and cities of the district.

Myopia was found to be extremely common among Chinese elementary and secondary school students, with a 55.7% prevalence across six provinces. The rates were lowest among children aged 6-8 years old (35.8%), highest among those aged 10-12 years old (58.9%), lowest among those aged 13-15 years old (81.2%), and highest among those aged 16-18 years old (81.2%) [10].

**Table 1. Demographic status of the patients**

Mean Age Distribution	Primary school	Middle school	High School
	10.50± 0.86	14.09 ± 0.92	16.55 ± 0.89

**Table 2. Clinical history of the patients**

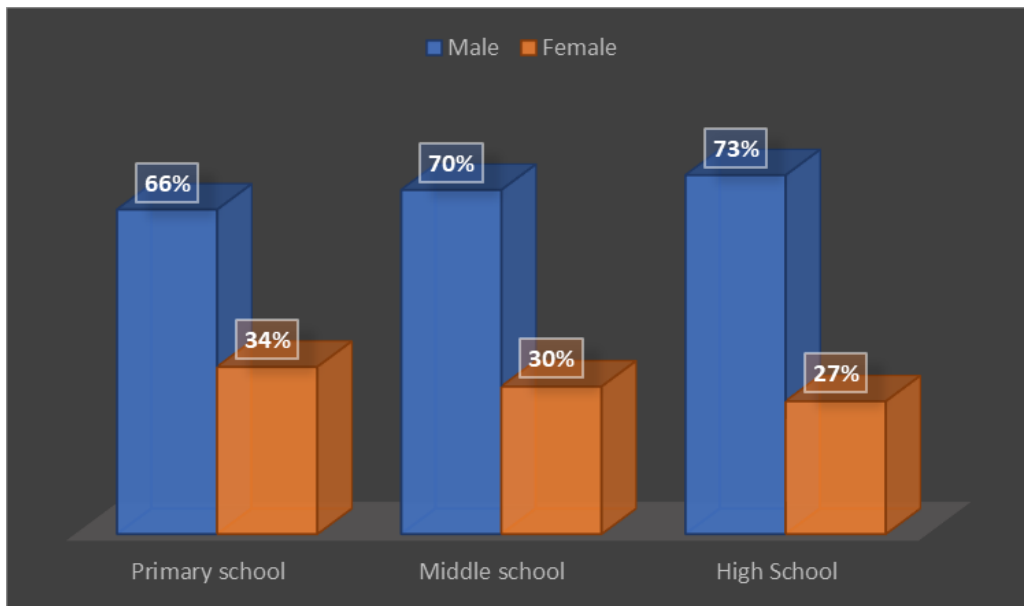
	<b>Primary school</b>	<b>Middle school</b>	<b>High School</b>
<b>The chest is more than the width of a fist from the edge of the table</b>			
Never	19%	15%	17%
Sometimes	21%	35%	36%
Usually	25%	25%	27%
Always	35%	25%	20%
<b>The eyes are more than 33 cm (one Chi) away from the book</b>			
Never	11%	12%	13%
Sometimes	39%	40%	42%
Usually	26%	30%	31%
Always	24%	18%	14%
<b>The finger is about 3.3 cm (one Cun) away from the tip of the nose</b>			
Never	12%	13%	14%
Sometimes	43%	40%	40%
Usually	29%	33%	34%
Always	14%	14%	12%
<b>Does your teacher remind you that your reading and writing posture is not correct?</b>			
Never	13%	12%	12%
Sometimes	45%	45%	43%
Usually	27%	27%	27%
Always	15%	14%	16%
<b>Do your parents remind you that your reading and writing posture is not correct?</b>			
Never	12%	12%	12%
Sometimes	44%	42%	43%
Usually	28%	30%	30%
Always	14%	14%	13%

**Table 3. Logistic regression of myopia-related factors by gender**

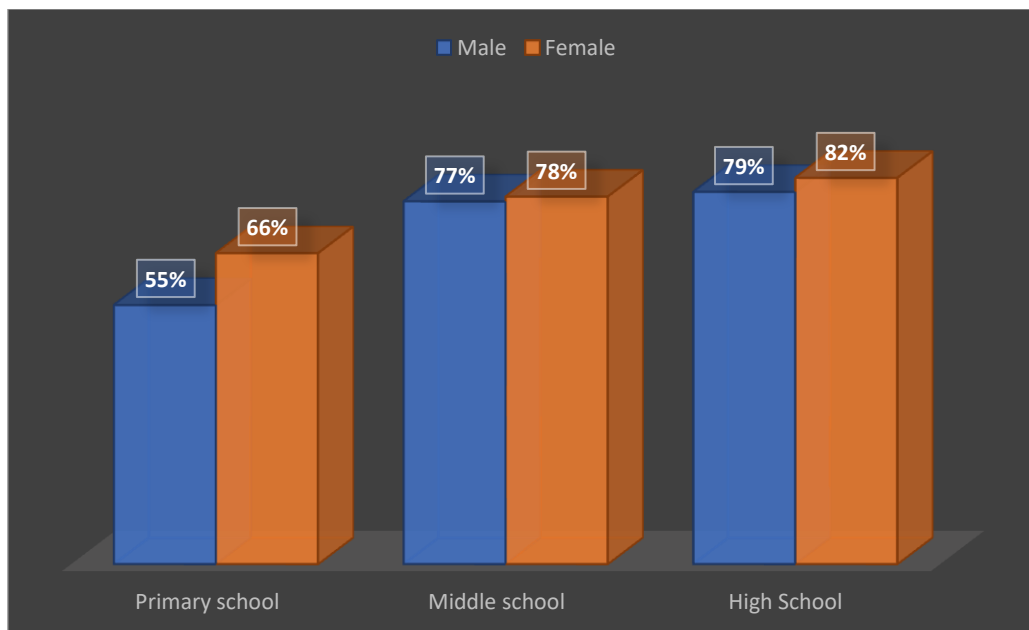
Myopia-related factors	Male		Female	
	OR (95% CI)	P value	OR (95% CI)	P value
Age	1.20 (1.06, 1.38)	0.006	1.26(1.09, 1.48)	0.002
The chest is more than the width of a fist from the edge of the table	Male		Female	
	OR (95% CI)	P value	OR (95% CI)	P value
Sometimes	1.27 (0.78, 2.07)	0.334	1.30 (0.73, 2.32)	0.373
Usually	1.27 (0.76, 2.13)	0.359	1.89 (1.03, 3.49)	0.041
Always	1.16 (0.67, 1.99)	0.598	2.01 (1.04, 3.88)	0.039
The eyes are more than 33 cm (one Chi) away from the book	Male		Female	
	OR (95% CI)	P value	OR (95% CI)	P value
Sometimes	1.51 (0.92, 2.49)	0.103	0.52 (0.28, 0.97)	0.041
Usually	1.49 (0.86, 2.58)	0.152	0.49 (0.25, 0.96)	0.036
Always	0.93 (0.52, 1.64)	0.790	0.31 (0.15, 0.64)	0.001
The finger is about 3.3 cm (one Cun) away from the tip of the nose	Male		Female	
	OR (95% CI)	P value	OR (95% CI)	P value
Sometimes	0.61 (0.39, 0.96)	0.033	1.01 (0.62, 1.65)	(0.62, 1.65)
Usually	0.78 (0.49, 1.25)	0.303	0.67 (0.41, 1.09)	0.110
Always	0.87 (0.55, 1.37)	0.550	0.93 (0.57, 1.49)	0.748
Does your teacher remind you that your reading and writing posture is not correct?	Male		Female	
	OR (95% CI)	P value	OR (95% CI)	P value
Sometimes	1.03 (0.71, 1.50)	0.882	1.01 (0.68, 1.51)	0.959
Usually	0.81 (0.52, 1.27)	0.353	0.84 (0.52, 1.36)	0.478
Always	0.62 (0.37, 1.03)	0.064	0.92 (0.54, 1.57)	0.757
Do your parents remind you that your reading and writing posture is not correct?	Male		Female	
	OR (95% CI)	P value	OR (95% CI)	P value
Sometimes	1.11 (0.70, 1.74)	0.666	0.666	1.43 (0.84, 2.44)
Usually	1.22 (0.74, 2.00)	0.440	2.03 (1.14, 3.61)	0.016
Always	2.22 (1.28, 3.87)	0.005	1.90 (1.05, 3.45)	0.034

**Table 4. Logistic regression of myopia-related factors by school type**

Myopia-related factors	Primary school		Middle school		High School	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Age	1.55 (1.33, 1.80)	<0.001	1.15 (0.97, 1.38)	0.111	0.82 (0.65, 1.03)	0.083
The chest is more than the width of a fist from the edge of the table	Primary school		Middle school		High School	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Never						
Sometimes	1.25 (0.76, 2.05)	0.376	1.93 (0.95, 3.94)	0.070	0.50 (0.17, 1.47)	0.206
Usually	1.54 (0.91, 2.60)	0.107	3.60 (1.66, 7.80)	0.001	0.37 (0.12, 1.09)	0.072
Always	1.70 (0.97, 3.00)	0.065	2.79 (1.25, 6.26)	0.013	0.33 (0.11, 1.02)	0.054
The eyes are more than 33 cm (one Chi) away from the book	Primary school		Middle school		High school	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Never	-	-	-	-	-	-
Sometimes	0.78 (0.46, 1.30)	0.339	1.02 (0.47, 2.20)	0.970	1.86 (0.81, 4.26)	0.143
Usually	0.97 (0.55, 1.71)	0.913	0.58 (0.25, 1.31)	0.187	1.80 (0.74, 4.40)	0.198
Always	0.55 (0.30, 0.99)	0.046	0.37 (0.15, 0.90)	0.028	1.17 (0.43, 3.22)	0.762
The finger is about 3.3 cm (one Cun) away from the tip of the nose	Primary school		Middle school		High school	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Never	-	-	-	-	-	-
Sometimes	1.00 (0.63, 1.60)	0.996	0.41 (0.21, 0.79)	0.008	0.86 (0.42, 1.75)	0.666
Usually	0.72 (0.45, 1.16)	0.181	0.63 (0.32, 1.25)	0.187	0.79 (0.38, 1.67)	0.536
Always	0.96 (0.61, 1.51)	0.858	0.66 (0.34, 1.29)	0.225	1.23 (0.59, 2.58)	0.578
Does your teacher remind you that your reading and writing posture is not correct?	Primary school		Middle school		High school	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Never	-	-	-	-	-	-
Sometimes	0.93 (0.60, 1.42)	0.731	1.03 (0.62, 1.71)	0.921	1.15 (0.68, 1.94)	0.599
Usually	0.89 (0.54, 1.44)	0.625	0.86 (0.47, 1.58)	0.634	0.55 (0.28, 1.09)	0.085
Always	0.73 (0.44, 1.22)	0.231	0.93 (0.47, 1.82)	0.820	0.65 (0.20, 2.08)	0.464
Do your parents remind you that your reading and writing posture is not correct?	Primary school		Middle school		High school	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Never	-	-	-	-	-	-
Sometimes	1.31 (0.76, 2.24)	0.328	1.34 (0.71, 2.51)	0.369	0.91 (0.46, 1.76)	0.770
Usually	1.56 (0.87, 2.80)	0.137	1.39 (0.71, 2.72)	0.343	1.52 (0.72, 3.18)	0.271
Always	1.96 (1.07, 3.57)	0.029	1.91 (0.93, 3.92)	0.077	2.49 (0.88, 7.08)	0.087



**Fig. 1. Gender distribution**



**Fig. 2. Myopia prevalence according to gender**

Higher rates of myopia were seen in our sample of schoolchildren compared to kids from other nations.

Myopia prevalence was 3.3% in the 6–7-year-old age group and 19.9% in the 12–13-year-old age group among the 1,626 people studied in the Ireland Eye Study [11].

According to Jorge et al., only 23.4% of Portuguese first-year college students suffer from myopia [12].

Retinal image quality, convergence and accommodation needs, and binocular comfort are all factors that can be affected by one's position when reading or writing, as well as one's enjoyment of these activities [13].

As a result of this, several researchers hypothesized that the way in which we hold ourselves when reading and writing might be a significant contributor to the onset of myopia [14].

Children aged 9-11 years old (n = 10,743) were tracked for 2 years as part of the Myopia Investigation Study in Taipei [15].

Students with a close work distance >30 cm and who stopped near work every 30 minutes had considerably reduced myopic growth after controlling for gender and high parental myopia.

After controlling for other variables, the continued significance of these characteristics indicates that they are independent risk factors.

Similarly, Ip et al. [16] showed that more time spent reading for pleasure and a shorter distance between the reader and the text were both significantly associated with higher levels of happiness.

Our research also found that students who read with their eyes further than 33 centimeters from the page and whose fingers are further than 3.3 centimeters from the tip of their nose were less likely to develop myopia. Our results mostly agreed with those of other researchers.

Bao et al. studied 120 myopic children between the ages of 6 and 13 and found that working distance shrank considerably with time for the reading and writing activities (p 0.001) [17].

Wu et al. analyzed data from 4,677 students between the ages of 16 and 18, and found that myopia was linked to both increased near work time (OR = 1.43, 95% CI: 1.06-1.93) and decreased near work distance (OR = 1.87, 95% CI: 1.55-2.26) [18].

However, reading behavior is not a constant but varies by grade and reading settings, suggesting that reading behavior may be adjusted by better ergonomics and text design, which may help reduce myopia and improve reading skills among schoolchildren [19-21].

Myopia risk factors included parents who were reminded of proper reading and writing postures and children whose chests were less than a fist's length from the edge of the table.

Myopia in school-aged children may encourage parents to pay more attention to their children's reading and writing postures and prompt them to set more reminders, leading to prevalence-incidence bias.

We will consider further refining the questionnaires and verifying them in a larger population sample because the results for the

chest-to-table distance remained counterintuitive. This is because it is possible that school students misunderstood the question, or that maintaining the chest-to-table distance can cause other changes in reading and writing postures.

## 5. CONCLUSION

In this article, we focused on the links between myopia and reading and writing positions, but we didn't account for all the factors that contribute to nearsightedness.

In conclusion, it may be beneficial to avoid and control myopia by keeping a healthy distance (>33 cm) between the eyes and the book.

## CONSENT AND ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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