

# Prevalence and risk factors of asthenopia among the students of Kermanshah, Iran

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## INTRODUCTION

Asthenopia is a term used to describe a variety of non-specific symptoms associated with the use of visual system, especially during near work.<sup>1</sup> There are two groups of symptoms; non-specific symptoms include fatigue, burning, irritation, eye pain, aching eyes, sore eyes, and headache; specific symptoms have been defined as symptoms such as photophobia, blurred vision, double vision, itching, tearing, dryness feeling, and foreign body sensation.<sup>2</sup> Along with increased use of computer devices and other near work in children, the prevalence of asthenopia and its associated complaints are expected to increase.<sup>3</sup>

Review of different studies in children show that the prevalence of asthenopia and certain symptoms ranges from less than 15% to over 80%, and headache is one of the most common symptom reported in most studies.<sup>4</sup> The purpose of this study was to determine the prevalence of asthenopia and its related factors in a students population of Iran as it has not been reported in any age group of Iranian students.

## METHODS

### Population and Samples

The target population was high school students in Kermanshah, Iran. Samples were selected through multi-stage cluster sampling. First, a number of boys' and girls' high schools were selected. Then, from each school, a number of students in each class were randomly selected proportionate to the total number of students in the school. After sample selection, consent forms were distributed to be signed by parents.

### Examinations

Before the examinations, each student was interviewed and asked a number of questions regarding his/her near work and studying habits. After completing the questionnaire of asthenopia symptoms, eye examinations included ophthalmoscopy, refraction by using an auto refractometer (Topcon RM8800), and checked by retinoscopy (Heine Beta 200). Visual acuity with and without correction, visual acuity with present glasses, subjective refraction, cover test, amplitude of accommodation, near point of convergence, stereopsis.

The near point of accommodation (NPA) was measured with Donder's push-up method using RAF Rule and near print equivalent to 20/25 VA as accommodative target and the average of three NPA was recorded. The average NPA was then converted to amplitude of accommodation (AA) in Diopter. The near point of convergence (NPC) was measured three times with the same manner as AA; instead, the participant was instructed to report the first sustained diplopia of the target and average measurement was recorded. The gradient accommodative-convergence / accommodation (AC/A) ratio was determined by re-measurement of near phoria by adding -1.00 minus lenses to the baseline near phoria value. All optometric tests were completed by an experienced optometrist.

### Definition of asthenopia

To diagnose asthenopia, the 10 symptoms of eye pain, dry eyes, eye swelling, blurred vision, diplopia, foreign body sensation, photophobia, tearing, decreased visual acuity, and difficulty in sustaining visual operations were investigated in detail through face to face interviews by a trained interviewer. In line with previous studies, any person with at least one of these symptoms was considered to have asthenopia. Nonetheless, to show its degree, we also determined the percentage of people with at least 2, 3 and 4 symptoms.

### Statistical analysis

The prevalence of asthenopia is presented in percentage along with 95% confidence intervals (CI). Logistic regression was used to examine possible relationships, and mean values of quantitative variables was compared between students with and without asthenopia using the t-test. A significance level of 5% was applied in all statistical tests.

### Ethical Issues

The Ethics Committee of Mashhad University of Medical Sciences approved the study protocol, which was conducted in accord with the tenets of the Helsinki Declaration. All participant's parent signed a written informed consent.

## RESULTS

Of the 1070 selected students, 1040 were included in the study, and after applying exclusion criteria, the results of 901 students were analyzed. The mean age of the subject was 15.1 ± 1.6 years.

The prevalence of asthenopia by age, gender, and degree of asthenopia is summarized in Table 1. Based on the definition of having at least 1, 2, 3 and 4 symptoms, 49.4% (45.7-53.2), 24.9% (21.7-28.2), 14.4% (11.8-17.0), and 9.1% (6.9-11.2), of the subjects had asthenopia respectively (Table 1). The prevalence of asthenopia was 62.8% (51.9-73.8) in boys and 47.7% (43.8-51.7) in girls (P=0.013, odds ratio=1.85, 95% CI: 1.14-3.0). The prevalence of asthenopia increased from 21.4% in 12-year-olds to 63.9% in 18-year-olds (p<0.001). Asthenopia with at least 4 symptoms was not observed in 12-year-olds, while 19.4% of the 18-year-old age group had at least 4 symptoms. As illustrated in Figure 1, the most common symptom was tearing and eye pain during near work, while difficulty in sustaining visual operations was reported by only 0.14% of the students. As presented in Table 2, the average time spent using cell phones and computers was significantly higher in students with asthenopia, while most other activities were not significantly different between the two groups. Table 3 summarizes the mean and standard deviation of the AA, NPC and AC/A ratio in students with and without asthenopia; t-test results indicated significantly lower AA and AC/A ratio and a significantly higher NPC in students with asthenopia. About 50.2% of the students with normal stereopsis and 47.9% of those with abnormal stereopsis (>120 sec arc) had asthenopia (p=0.562). Mean near esophoria in students with and without asthenopia was 0.61 prism diopter (PD) and 0.40 PD (p=0.165), respectively. The prevalence of near exophoria defined with a cut point of 6 PD was 54.9% in students with asthenopia and 48.3% in those without this condition (p=0.142).

Table 1. Prevalence of asthenopia (percentage and 95% confidence interval) among 12-to-18-year-old students by age and gender

	Number of symptoms			
	1 and more % (95%CI)	2 and more % (95%CI)	3 and more % (95%CI)	4 and more % (95%CI)
Total	49.4 (45.7-53.2)	24.9 (21.7-28.2)	14.4 (11.8-17.0)	9.1 (6.9-11.2)
Gender				
Female	47.7 (43.8-51.7)	24.7 (21.3-28.1)	14.1 (11.4-16.9)	8.8 (6.5-11.0)
Male	62.8 (51.9-73.8)	25.9 (16.9-37.0)	16.7 (8.2-25.1)	11.5 (4.3-18.8)
Age (years)				
12	21.4 (10.3-32.5)	5.4 (0.7-11.4)	0	0
13	37.1 (24.7-49.5)	11.3 (3.2-19.4)	3.2 (1.1-7.7)	1.6 (1.2-4.8)
14	39.3 (29.8-48.7)	15.9 (8.8-22.9)	8.4 (3.1-13.8)	3.7 (3.1-7.4)
15	54.7 (47.1-62.3)	28.2 (21.4-35.1)	20.6 (14.4-26.7)	11.8 (6.9-16.7)
16	61.6 (54.1-69.1)	33.5 (26.2-40.8)	17.1 (11.3-22.9)	12.2 (7.1-17.3)
17	49.5 (39.5-59.5)	29.3 (20.2-38.4)	17.2 (9.6-24.7)	11.1 (4.8-17.4)
18	63.9 (47.4-80.4)	38.9 (22.2-55.6)	25.0 (10.1-39.9)	19.4 (9.5-33.0)

Table 2. Mean and standard deviation (SD) time (hours) spent performing certain near work activities, sleeping, and exercising among students with and without asthenopia.

	Normal	Asthenopia	p-value
	Mean±SD	Mean±SD	
Using computers - daily	1.29±1.52	1.58±1.98	0.034
Using cell phones - daily	2.18±2.47	2.87±2.85	0.001
Studying and reading - daily	3.83±2.25	3.88±2.22	0.790
Watching TV - daily	2.43±1.95	2.66±1.92	0.122
Looking at the board in class - daily	4.99±1.76	4.97±2.05	0.887
Sleeping - daily	7.66±1.72	7.6±2.05	0.650
Participating in sports and exercise - weekly	2.57±3.53	2.35±3.4	0.406

Table 3. Mean and standard deviation (SD) of amplitude of accommodation (AA), near point of convergence (NPC) and AC/A ratio among students with and without asthenopia.

	Normal	Asthenopia	p-value
	Mean±SD	Mean±SD	
AA (D)	10.51±1.87	10.09±2.22	0.006
NPC (cm)	5.65±1.81	6.13±2.36	0.003
AC/A (prism Diopter/Diopter)	2.53±1.35	2.32±1.27	0.034

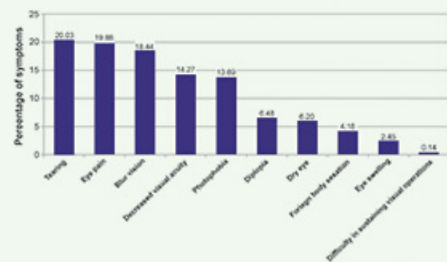


Figure 1. The prevalence of symptoms during near work

## CONCLUSIONS

The results of this study indicated that the prevalence of asthenopia in students population is high and one out of two students has asthenopia. Since asthenopia can interfere with near work, the treatment of this condition merits high importance in school-age children. Certain accommodation indices significantly correlate with asthenopia; although tearing and eye pain were the most common symptom for asthenopia.

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