

# Prevalence and risk indicators of myopia among schoolchildren in Amman, Jordan

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معدّل انتشار قصر النظر ومؤشّرات اختطاره بين تلاميذ المدارس في عمّان، الأردن

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**الخلاصة:** استهدفت هذه الدراسة تحديد معدّل انتشار الحَسَر (قصر النظر) ومؤشّرات اختطاره بين تلاميذ المدارس. فتمّ انتقاء 1777 من التلاميذ (1081 من الذكور، و696 من الإناث) في الفئة العمرية 12 – 17، من 8 مدارس انتقاء عشوائياً من 8 مواقع جغرافية مختلفة في عمّان. وجمعت المعطيات عن طريق استبيان، وتم التحقق من الحَسَر الذاتي التبليغ، في ضوء السجلات الطبية المدرسية. وقد بلغ معدّل انتشار الحَسَر 17.6٪، مع عدم وجود فروق جوهرية بين الذكور والإناث، بعد تعديل النتائج لتأخذ في الاعتبار متغيّرات أخرى محتملة. وكان الحَسَر وثيق الارتباط بالعمر، وسوابق وجوده في الأسرة، واستخدام الحاسوب، والقراءة والكتابة خارج المدارس. وتبيّن وجود ترابط عكسي بين الحَسَر وبين ممارسة الرياضة، في حين لم يُلاحظ ترابط بين الحَسَر وبين مشاهدة التلفاز.

**ABSTRACT** We aimed to identify the prevalence and risk factors of myopia among secondary-school students in Amman. Thus 1777 (1081 males and 696 females) students aged 12–17 years old were recruited from 8 schools randomly selected from 8 different geographic locations in Amman. Data were collected by questionnaire, and self-reported myopia was checked against school medical records. The prevalence of myopia was 17.6%, with no significant difference between males and females after adjusting for other possible variables. Myopia was significantly associated with age, family history of myopia, computer use, and reading and writing outside school. Playing sports was inversely associated with myopia but there was no association with watching television.

## Prévalence et indicateurs de risque de la myopie chez des collégiens à Amman (Jordanie)

**RÉSUMÉ** Notre objectif était d'identifier la prévalence de la myopie et les facteurs de risque chez des élèves du secondaire à Amman. Ainsi, 1777 élèves (1081 garçons et 696 filles) âgés de 12 à 17 ans ont été recrutés dans 8 écoles choisies au hasard dans 8 lieux géographiques différents à Amman. Des données ont été recueillies par questionnaire et la myopie déclarée a été vérifiée par rapport aux dossiers médicaux scolaires. La prévalence de la myopie était de 17,6 %, sans différence significative entre les garçons et les filles après ajustement en fonction d'autres variables possibles. La myopie était significativement associée à l'âge, aux antécédents familiaux de myopie, à l'utilisation d'un ordinateur, et à la lecture et l'écriture en dehors du cadre scolaire. Pratiquer un sport était inversement associé avec la myopie mais regarder la télévision n'était pas un facteur associé.

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## Introduction

Myopia is the most common eye disorder in the world. High myopia ( $> -6$  diopters) may be associated with glaucoma, cataract, retinal degeneration and myopic macular degeneration [1].

Several studies worldwide have shown that the prevalence of myopia varies considerably from one geographic area to another and that the prevalence has been increasing over that past few decades [2]. It is reported to be high (up to 80%) in the student population in Asia [2]. In a national survey of children in Taiwan, Lin et al. reported the prevalence of myopia to be over 70% [3].

Considerable research has been done to determine the risk factors of myopia [4–17]. The results of these investigations support both genetic and environmental components. Physiological myopia is thought to be a multifactorial condition with both genetic and environmental factors [4]. Twin studies and segregation analysis studies have indicated that myopia is hereditary [5]. On the environmental front, near work is the most commonly implicated environmental factor, both by animal studies in monkeys [6–8] as well as by epidemiological studies [9]. Other possible risk factors include age, sex, education, occupation, intelligence, high socioeconomic status and decreased outdoor activities [10–16].

Studies on eye diseases in Jordanian schoolchildren are rare and there are few data on myopia [18]. Therefore, this study was conducted to identify the prevalence and risk factors of myopia among secondary-school students in Amman in order to provide baseline information on this condition for health care organizations.

## Methods

This was a cross-sectional study of schoolchildren aged 12–17 years attending secondary schools in Amman city. There are a total of 770 schools in Amman with a total of 240 634 students. We divided Amman into 8 geographic locations of approximately the same size of student population and 1 school from each location was selected by simple random sampling. Two of these schools were private and the other 6 were public schools. All children (1931) between 12 and 17 years of age in the 8 selected schools were asked for their and their parents' permission to participate in this study. A total of 1777 (92%) of the children agreed to participate: 1081 males and 696 females.

A questionnaire was constructed with the help of 2 ophthalmologists and was pilot tested with 75 children. The questionnaire was modified accordingly and given to all students by trained members of the research team who explained the purpose of this study and how to complete the questionnaire properly. The students were asked to fill the questionnaire at home in the presence and with the help of one of their parents. Participants were followed up to ensure return of the questionnaire. The section of the questionnaire concerning self-reported myopia and other eye problems was rechecked from the school medical records which contain a yearly updated eye test. Myopia was defined as spherical error of at least  $-0.50$  diopters. Information on age, sex, socioeconomic status and family history of myopia was obtained. Near-work activity (visual task performed at a near distance) was measured by questions on the amount of time in hours per day spent on near-work

activity outside school on weekdays and weekends. Individual near-work activity tasks included reading and writing, watching television and working on the computer. Information about physical exercises was also collected.

Descriptive statistics, univariate analysis using the chi-squared test for categorical variables and independent *t*-test for continuous variables, and binary logistic regression were performed using *SPSS*, version 11.0. A *P*-value < 0.05 was considered statistically significance.

## Results

Table 1 shows the demographic characteristics and family history of myopia of the 1777

children (60.8% males and 39.2% females). About 8.6% of children were 12 years old, 19.2% were 13 years old, 21.9% were 14 years old, 18.6% were 15 years old, 23.4% were 16 years old, and 8.3% were 17 years old. A total of 54.6% of children had a family history of myopia.

Overall, there were 313 (17.6%) children with myopia. The prevalence of myopia was significantly higher in females (20.3%) compared to males (15.9%) (*P* = 0.019). Myopia was also significantly related to age. The prevalence was lowest for the youngest age group (7.8%) and increased until it reached 20.6% for 14-year-old children. After this age, the prevalence decreased gradually. The prevalence among children varied according to the family history based on who was af-

**Table 1 Demographic characteristics, family history of myopia, and the prevalence of myopia among schoolchildren aged 12 to 17 years old in Amman, Jordan**

Variable	No. examined	Children with myopia		<i>P</i> -value
		No.	%	
Sex				0.019
Male	1081	172	15.9	
Female	696	141	20.3	
Age (years) <sup>a</sup>				< 0.001
12	154	12	7.8	
13	340	42	12.4	
14	388	80	20.6	
15	331	67	20.2	
16	415	83	20.0	
17	147	29	19.7	
Family history of myopia				< 0.001
No family history	807	70	8.7	
1 myopic parent only	277	50	18.1	
2 myopic parents only	66	16	24.2	
1 myopic parent with at least 1 myopic sibling	516	129	25.0	
2 myopic parents with at least 1 myopic sibling	111	48	43.2	

<sup>a</sup>The ages of 2 participants were missing.

**Table 2 Difference between myopic and non-myopic children in the time they spend on activities outside school**

Activity	No myopia (n = 1464)		Myopia (n = 313)		t-test	P-value
	Mean	SD	Mean	SD		
Watching television	1.80	0.79	1.71	0.48	1.94	0.0525
Playing sports	4.04	2.82	1.87	2.33	12.72	< 0.0001
Reading and writing	2.54	1.45	3.07	1.53	5.81	< 0.0001
Using the computer	0.69	0.64	0.95	0.46	6.82	< 0.0001

SD = standard deviation.

ected and the number of persons affected in the family. The prevalence was 8.7% for those who had no family history, and was highest for those with 2 myopic parents and with at least 1 myopic sibling (43.2%).

**Table 3 Factors associated with myopia in binary logistic regression analysis**

Variable	Odds ratio	95% confidence interval
<i>Age<sup>a</sup> (years)</i>		
13	1.51	0.74–3.09
14	2.45	1.24–4.85
15	2.45	1.23–4.89
16	2.78	1.41–5.49
17	2.40	1.12–5.14
<i>Family history<sup>b</sup></i>		
1 myopic parent	2.20	1.58–3.06
2 myopic parents	3.37	1.77–6.42
1 myopic parent with at least 1 myopic brother/sister	4.75	3.19–7.06
2 myopic parents with at least 1 myopic brother/sister	5.44	2.65–9.88
<i>Activity</i>		
Using a computer	1.16	1.06–1.26
Playing sports	0.89	0.86–0.93
Reading and writing at home	1.24	1.14–1.35

<sup>a</sup>Reference group = age 12 years.

<sup>b</sup>Reference group = no family history of myopia.

With regard to the activities outside school, myopic and non-myopic children differed in the time they spent on these activities (Table 2). Myopic children spent significantly more time reading and writing outside school and in computer work compared with non-myopic children. Although myopic children spent less time watching television (1.7 hours per day) compared to non-myopic children (1.8 hours per day), this difference was not significant. On the other hand, myopic children spent significantly less time (1.87 hours per day) playing sports compared to non-myopic children (4.04 hours per day).

In the binary logistic regression analysis, the variables that were significantly associated with having myopia were age, family history, computer work, playing sports and reading/writing at home (Table 3). The odds of having myopia increased by 16% and 24% for each additional 1 hour spent on computer work and writing/reading outside of school respectively. While watching television was not significantly associated with myopia, playing sports was negatively associated with myopia.

## Discussion

The occurrence of myopia varies in different countries as well as different localities [19,20]. The prevalence of myopia among school-

children in Amman in our study was 17.6%. The prevalence was significantly higher in females than males but this difference was no longer significant after adjusting for other possible variables. The prevalence of myopia was significantly associated with age, being the lowest in the youngest age group. Children with a family history of myopia were more likely to have myopia. With regard to activities outside of school, myopic children spent significantly more time in computer work and reading and writing and less time in sports activities. These relationships remained significant even after controlling for possible confounders. On the other hand, hours spent watching television were not associated with myopia.

The prevalence of myopia in the 12-year-olds in our study (7.8%) was slightly higher than that in Oman for the same age group (5.16%) [21]. Our results are consistent with previous epidemiological studies and support the evidence of the near-work hypoth-

esis [16,22]. The association between daily hours spent on reading and writing outside school and myopia was consistent with results obtained from other cross-sectional and case-control studies [8,16,19-23].

The association we found between myopia and number of parents with myopia contradicts the results of a cross-sectional study of myopia in kindergarten children in Singapore [24], while it supports the results of another study that indicated that there is a familial component in myopia [5].

As our study was limited to data from 8 schools it may not be possible to generalize the results to the whole Jordanian population. Prospective longitudinal studies are needed to establish a causal relationship between near work and myopia in this age group. Similar measurements taken at birth to establish if such a state is congenital may provide further insight into the inheritance of myopia. Future studies should involve large sample sizes and long follow-up periods.

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