

Research Article

The Prevalence of Myopia and its Associated Factors Among School-Aged Children in Pamijahan Village, Bogor District

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Abstract

Globaly, the prevalence of refractive errors, especially myopia in children, has increased significantly. The cause of myopia is multifactorial. Near-work activities and family history are some suggested factors associated with myopia. However, there has not been enough data on these factors and their association with myopia in Indonesia. This study aims to determine the prevalence and factors associated with myopia in primary and middle school-aged children in Pamijahan Village, Bogor District, West Java, Indonesia. Data were taken in a cross-sectional design based on the visual acuity, anterior and posterior eye examination. A 14-item questionnaire regarding myopia-associated factors including family history, playing outdoors, and near-work activities, was distributed to the subjects. The data were taken from June to September 2018. Analysis was conducted using SPSS version 20. The prevalence of myopia in Pamijahan Village is 4,9% out of 474 subjects. Family history, including parental ($p=0.001$, OR 4.49) and sibling history ($p=0.001$, OR 5.58), was shown to be associated with the increasing risk of myopia in children while near-work activities and playing outdoors were not associated with myopia in children of Pamijahan Village.

Keywords: family history, myopia, near-work activities, school-age children.

Prevalensi Myopia dan Faktor-faktor yang Berhubungan pada Anak Usia Sekolah di Desa Pamijahan Kabupaten Bogor

Abstrak

Prevalensi kelainan refraksi, terutama miopia pada anak di dunia, meningkat signifikan. Penyebab miopia adalah multifaktorial. Aktivitas jarak dekat dan riwayat keluarga merupakan faktor yang diduga terkait dengan miopia. Namun, belum ada cukup data mengenai faktor-faktor yang berhubungan dengan miopia di Indonesia. Penelitian ini bertujuan untuk mengetahui prevalensi dan faktor-faktor yang berhubungan dengan miopia pada anak usia sekolah dasar dan menengah di Desa Pamijahan, Kabupaten Bogor, Jawa Barat. Penelitian ini menggunakan desain potong lintang meliputi data hasil visus, serta pemeriksaan mata anterior dan posterior. Kuesioner berisi 14 pertanyaan untuk menentukan faktor-faktor yang berhubungan dengan miopia meliputi riwayat keluarga, aktivitas di luar ruangan, dan aktivitas jarak dekat seperti penggunaan smartphone atau membaca buku. Data penelitian diambil pada bulan Juni sampai September 2018. Analisis data menggunakan SPSS versi 20. Prevalensi miopia di Desa Pamijahan 4,9% dari 474 subjek. Riwayat keluarga yang berhubungan dengan kejadian miopia meliputi riwayat orangtua ($p=0,001$ OR 4,49) dan saudara kandung ($p=0,001$ OR 5,58). Durasi aktivitas jarak dekat seperti menonton televisi, menggunakan smartphone, dan membaca buku tidak berhubungan dengan prevalensi miopia yang lebih tinggi. Riwayat keluarga berhubungan dengan peningkatan risiko miopia, sedangkan aktivitas jarak dekat dan aktivitas di luar ruangan tidak berhubungan dengan miopia pada anak di Desa Pamijahan.

Kata kunci: aktivitas jarak dekat, anak usia sekolah, miopia, riwayat keluarga.

Introduction

Refractive error is the world's second most common cause of blindness (World Health Organization).¹ The prevalence of refractive errors, especially myopia, has been increasing dramatically for the past few years. Up to 90% of teenagers and the young population in East Asia are shortsighted, possibly due to more time spent reading, studying, or using gadgets and smartphones. The increasing prevalence was also found in the United States and Europe. This condition is known as the myopia boom. It is predicted that by the end of this decade, one-third of the worldwide population will be myopic.²

Researchers are trying to find the cause of this phenomenon. Genetic factors are known as one of the causes of myopia. Studies have identified genes associated with nerve cell function, metabolism, and eye development that increased myopia incidence ten-fold.³ Moreover, children who have myopic parents tend to have higher chances of being shortsighted.^{4,5}

A child's activities can contribute to the development of myopia. Recent studies revealed that spending time outdoors may protect the eye from and decrease the incidence of myopia regardless of whether there is a history of myopia in the family or ethnicity.⁶ More time spent on near-work activities, such as reading, writing, playing on smartphones, and working on a computer, are associated with a higher likelihood of developing myopia.

The prevalence of myopia in Indonesia is still unknown. Prior studies in Asia and western countries were conducted with different schooling systems, schools' indoor and outdoor activities, and hours spent studying. On the other hand, there is little data about the association between children's activities and myopia's prevalence in Indonesia. We did our research in rural West Java as we assumed that children in rural areas would spend more time in outdoor activities. This study aims to investigate the prevalence of myopia in children aged 6-16 years living in a rural area in Pamijahan Village, West Java. This cross-sectional study also aims to explore the potential factors associated with myopia. This study is a pioneer in exploring factors associated with myopia in the rural area of West Java.

Methods

This is a cross-sectional study to identify the prevalence of myopia and its associated factors among elementary and junior high school students

in a West Java village. Data were collected from June to September 2018. Informed consent letters from each student were obtained after the researcher explained the study to one of the parents or responsible adults.

The population for this study is school-aged children who attended Daarul Mustaqim Islamic Boarding School in Pamijahan Village, Bogor, West Java. The inclusion criteria were all students from boarding schools, Madrasah Ibtidaiyah and Madrasah Tsanawiyah Daarul Mustaqim Islamic Boarding School, Pamijahan Village, aged 6-16 years old, who came during the period of data collection. The exclusion criteria were students with abnormalities on the anterior or posterior segments and students who were unwilling to participate in the study. The minimum sample size for this study is 373. Sampling was carried out by convenient sampling technique. A total of 474 students completed the questionnaires and agreed to do an eye examination. The dependent variable is the diagnosis of myopia based on complete eye examinations by ophthalmologists. Independent variables are daily activities, including watching television or playing on smartphones, reading books, playing outdoors, extracurricular activities, and history of parents or siblings with refractive errors; all were obtained using a validated questionnaire.

Myopia diagnosis was achieved by visual acuity examination using a three-meter E chart. Refractive errors are categorized as myopia if the measured refraction >-0.50 diopters, hypermetropia if the measured refraction $>+1.00$ diopters, and astigmatism if the measured refraction >1.00 diopters in one or both eyes. Furthermore, myopia will be divided into three groups, i.e., *low degree myopia* if the measured refraction <-3.00 diopters, *moderate degree* if it is between -3.00 diopters and -6.00 diopters, and *high degrees* if >-6.00 diopters. A slit lamp was used to examine the abnormalities in the anterior and posterior eye segments.

Daily activities and family history as independent variables were assessed using a questionnaire. A 14-item questionnaire was used to obtain the following information: demographic characteristics including age, gender, ethnicity, academic year; hours spent daily watching television, using smartphones, reading books, playing outdoors; the distance during extracurricular activities (far-sighted, near-sighted, or none); history of myopia in parents and siblings along with the correction glasses being used. The questionnaire has been

validated and used in some other studies.⁷⁻¹¹

Statistical analysis was assessed using the Statistical Package for Social Sciences (SPSS) version 20. Data related to associated factors regarding refractive errors were processed using the chi-square tests, t-test, Fisher-exact test, and Mann-Whitney. Data will be presented in odds ratio (OR) with a 95% confidence interval. A p-value <0.05 will be considered statistically significant.

Results

A total of 474 subjects were included in the analysis. The demographic characteristics of the subjects are presented in Table 1. The overall prevalence of myopia in Pamijahan Village was 4.9%. The prevalence of low, moderate, and high myopia was 3.2%, 1.3%, and 0.4%, respectively. There was no significant difference in the prevalence of myopia based on gender, age, and grade (p-value 0.177 and 0.173, respectively). Factors contributing to myopia such as time spent watching television or playing on smartphones, reading books, playing outdoors, or doing extracurricular activities, are presented in Table 2. It showed that there was

no significant difference between children with normal visual acuity and myopia. Students with a family history of myopia showed a higher likelihood of developing myopia, with an OR 4.49 (p-value 0.001) for students whose parents have myopia and an OR 5.58 (p-value 0.001) for students whose siblings have myopia.

Discussion

The prevalence of myopia in school-aged children in Pamijahan Village was 4.9%. This number was lower compared to another study in Indonesia involving school-aged children in Temanggung with a prevalence of myopia of 14.5%.¹² A higher prevalence of myopia (47.4%) was found in Guangzhou, China, among primary and middle school-aged children.¹³ Difference results of prevalence may be caused by the variety in race, ethnicity, age, and nature of the samples. Although not statistically significant, our findings showed that girls have a higher prevalence of developing myopia compared to boys (5.8% and 2.8%, respectively). This finding was consistent with the previous studies in Guangzhou and Beijing.¹⁴

Table 1. Associated Sociodemographic Factors in Children

Sociodemographic Factors	Total n (%) No	Myopia n (%)		p-value
		Yes		
Gender				
Boy	214	208 (97.2)	6 (2.8)	0.177*
Girl	260	245 (94.2)	15 (5.8)	
Myopia categories				
No myopia	451 (95.1)			
Low myopia	15 (3.2)			
Moderate myopia	6 (1.3)			
High myopia	2 (0.4)			
Age	11.27 (\pm 2.6)	11.25 (\pm 2.5)	11.62 (\pm 2.6)	0.559**
Grade				0.173*
Elementary school	186	181 (97.3)	5 (2.7)	
Junior-high school	288	272 (94.4)	16 (5.6)	
Total	474 (100)	451 (95.1)	23 (4.9)	

*chi-square test **Mann-Whitney test

Table 2. Associated Risk Factors Contributing to Myopia

Risk Factors	Total n (%)	No Myopia n (%)	Myopia n (%)	p-value	OR
Watching television or playing smartphones				0.127*	
< 2 hours/day	176	172 (97.7)	4 (2.3)		
2-4 hours/day	223	210 (94.2)	13 (5.8)		
>4 hours/day	75	71 (94.7)	4 (5.3)		
Reading books				0.110*	
< 2 hours/day	301	291 (96.7)	10 (3.3)		
2-4 hours/day	163	153 (93.9)	10 (6.1)		
>4 hours/day	10	1 (10)	9 (90)		
Playing outdoors				0.854*	
< 2 hours/day	234	224 (95.7)	10 (4.3)		
2-4 hours/day	199	190 (95.5)	9 (4.5)		
>4 hours/day	41	39 (95.1)	2 (4.9)		
Doing extracurricular activities				0.822*	
Yes	272	259 (95.2)	13 (4.8)		
No	202	194 (96)	8 (4)		
Parents with myopia				0.001**	OR 4.49
Yes	100	89 (89)	11 (11)		
No	374	364 (97.3)	10 (2.7)		
Siblings with myopia				0.001**	OR 5.58
Yes	53	8 (15.1)	45 (84.9)		
No	421	13 (3.1)	408 (96.9)		

*Mann-Whitney test **Chi-square test

In our study, the duration of near-work activities such as watching television, using smartphones, and reading were not associated with a higher prevalence of myopia. This result is similar to other cross-sectional studies that revealed near-work activities were not associated with myopia development.¹⁵⁻¹⁸ Lin et al.¹⁵ revealed that in research on 386 children aged 6-12 who lived in Beijing, the level of near-work time did not affect the prevalence of myopia after adjusting for age, gender, and family history of myopia. In a study by Lu et al.¹⁶ involving 1892 children in rural China, myopic children did not spend more time on near-work activities ($p=0.11$). Wu et al.¹⁸ found no association between myopia and near-work activities such as reading, writing, watching television, playing piano, or using a computer ($p=0.059$). However, a meta-analysis included 15 cross-sectional studies found that the incidence of myopia did increase with the escalation of time in near-work activity with OR 1.14.¹⁹ Research published by The Sydney Myopia Study (SMS)²⁰ and Lyu et al.²¹ showed that children who read for more than two to three hours a day

outside school hours were more likely to experience more severe myopia.

Our study is consistent with previous research which showed that family history is associated with the prevalence of myopia in children.^{22,23} Students with parental history of myopia showed a p-value of 0.001 with a 4.49 OR. Moreover, students with siblings' history of myopia showed a higher chance of developing myopia (p -value 0.001; OR 5.58).

This study has considerable strengths, in which our data was collected not only by questionnaires but also by refractive measurements and has a high participation rate. This study is one of the pioneer studies of myopia in Indonesia, especially in rural areas. However, questionnaires are not the most accurate tool to collect data due to the possibility of a recall bias.

Conclusion

There is a slight prevalence of myopia in primary and middle school-aged children. Family history was shown to be associated with the increasing risk of myopia, while near-work activities

and playing outdoors were not associated with myopia in children of Pamijahan village. Therefore, parents and teachers should focus more on educating and improving awareness of myopia screening, particularly in children with a family history of myopia.

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