

Original Article

Prevalence of amblyopia and its impact on the academic performance of male medical students in Southern Saudi Arabia



Khalid A. Fayi^{a,*}; Dhafer S. Alahmari^a; Dhafer S. Alamri^b; Yahya H. Al-Falki^c

Abstract

Purpose: To estimate the prevalence of amblyopia among medical students in Saudi Arabia, and investigate the impact of amblyopia on their Academic performance.

Methods: This is a cross-sectional study which targeted 478 of male medical students from the College of Medicine at King Khalid University. A questionnaire was used to investigate the demographics of participants. Distance visual acuity was assessed monocularly using tumbling "E" chart in all participants. Then detailed ophthalmic evaluation was performed for any student with two or more lines difference between the two eyes or visual acuity of $\leq 20/40$ in either eye.

Results: A sample of 478 male medical students, of whom 12(2.5%) were found to have amblyopia. Anisometropic amblyopia was the most common type (10/12, 83.3%) followed by strabismic amblyopia (2/12, 16.7%). There is a significant relation between past ocular history and amblyopia (p -value = 0.008). Up to 25% of amblyopic students not diagnosed before and 25% of them agree that amblyopia affects their social & psychiatric status. There was no effect of amblyopia on the academic performance (P -value = 0.5).

Conclusion: Amblyopia was found in 2.5% of male medical students. Amblyopia had a moderate effect on the students' lives, but it did not affect their academic performance.

Keywords: Amblyopia, Prevalence, Saudi Arabia, Medical students

© 2018 The Authors. Production and hosting by Elsevier B.V. on behalf of Saudi Ophthalmological Society, King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).
<https://doi.org/10.1016/j.sjopt.2018.09.002>

Introduction

Amblyopia which also known as the lazy eye is the reduction of best-corrected visual acuity of one or both eyes that cannot be attributed exclusively to a structural abnormality of the eye.¹ It develops during childhood and results in the interruption of normal cortical visual pathway development.¹

There are several factors which are predisposing factors for amblyopia, and they include refractive error, strabismus

which disrupt binocular vision development and media opacification.² However, the most common causes of amblyopia including early acquired cataract and congenital reason, also vitreous haemorrhage, corneal opacities and ptosis are other causes.³

Visual impairment commonly occurs in children and middle-aged adults as a result of amblyopia which affects almost up to 3% of the population.³ The prevalence of amblyopia is based on its definition and the studied population, in

Received 19 November 2017; received in revised form 7 June 2018; accepted 9 September 2018; available online 18 September 2018.

^a College of Medicine, King Khalid University, Abha, Saudi Arabia

^b Department of Family Medicine, Armed Forces Hospital, Khamis Mushayt, Saudi Arabia

^c Department of Ophthalmology, College of Medicine, King Khalid University, Abha, Saudi Arabia

* Corresponding author at: College of Medicine, King Khalid University, Abha, 61411, Saudi Arabia.

e-mail address: 434802551@kku.edu.sa (K.A. Fayi).

adults, the prevalence represents 1–5%.^{4–6} In a study from Australia, it was found that unilateral amblyopia prevalence was 3.06%.⁷ In children, it affects almost 2–3%. The prevalence of amblyopia is underestimated as there is a lack of awareness and detection.⁸

Based on the geographic area, the amblyopia prevalence varies in Saudi Arabia, in 1994 the prevalence of amblyopia in pre-school children in Riyadh was 2.6%, in school-age children in Abha was 1.9% and in Al-Baha city it was 1.6%.^{9–12} From a private hospital in Dammam, it was found that amblyopia represented 9.1% as a leading case of childhood eye morbidity.¹³

Amblyopia can present with different levels of severity, and it usually affects one eye only, although the other eye which is “non-amblyopic eye” often has an array of small but measurable deficits.² Amblyopia presence in one eye increases the risk of bilateral blindness which is caused either by injuries or age-related macular degeneration.^{14,15} In UK study, it was reported that the risk for individuals with amblyopia of visual impairment or blindness was estimated to be between 1% and 3%.¹⁴

Classification of amblyopia usually depends on the presence of a visual condition which believed to cause the impaired visual development.² Four categories were mentioned by Attebo et al.⁴; Anisometropic, Strabismic, Mixed and Stimulus deprivation.

Amblyopia can be treated in young children effectively, however leaving the case uncorrected causes abnormal neurodevelopment of the visual system and then visual loss which may be permanent.^{16–18} Many professionals of eye care thought that treatment after 6–7 years is ineffective and response to treatment may not happen, while others thought that age of 9–10 years is the upper limit for effective treatment.^{19–22}

As far as we know, there is a limited number of studies that evaluated the prevalence of amblyopia among adults, but there’s no study estimated its prevalence among medical students. So, this study aims to determine the prevalence of amblyopia among male medical students in Saudi Arabia and to investigate the impact of amblyopia on their academic performance.

Material and methods

This study is cross-sectional study which included 478 medical students aged between 19 and 26 years from the College of Medicine at King Khalid University. The study was performed between the period from Jan 2015 to Aug 2016. The study protocol was approved by the Ethics Committee of King Khalid University, and this research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Selection of participants was based on the simple random sampling method. The consent form was given to participants after the purpose and method of examination were explained to each one of them. Participants who were refusing were excluded. A questionnaire was used to investigate the demographics of participants which include information on age, study level, academic performance, past medical and surgical history.

Distance visual acuity was assessed monocularly using tumbling “E” chart with and without correction in all

participants. Any students with two or more lines difference between the two eyes or visual acuity of $\leq 20/40$ in either eye were requested to come to Asir Central Hospital (ACH) outpatient department for further evaluation.

In the outpatient department, a standard examination procedure was used for each participant. A detailed history of past and present ocular problems and treatments were obtained. Distance visual acuity was re-checked using tumbling “E” chart, and they were subjected to detailed eye examination including ocular movements, the Hirschberg test, cover-uncover tests, slit lamp examination, colour vision test using Ishihara chart, dilated fundus examination and detailed anterior and posterior segment evaluation were performed by ophthalmologists or trained optometrists.

For this study, amblyopia was defined as best corrected visual acuity (BCVA) $\leq 20/40$ in either eyes or the two-line difference between the two eyes, and the presence of an amblyogenic factor without any underlying structural abnormality of the visual pathway.

Data were analyzed using SPSS software version 16 for all analyses in this study, means and standard deviations were calculated for numerical data. Qualitative data were described using numbers and percent distribution, and chi-square was used as a test of significance to detect association variables, fisher Exact test was done for two by two tables if more than half of the expected values were less than 5 or any single expected value was less than 2, comparing was done using student t-test with a significant level of less than 0.05.

Results

The present study included 478 male medical students; there were 12(2.5%) of them had amblyopia, while 466 (97.5%) were non-amblyopic. 10(83.3%) of those with amblyopia had anisometropic amblyopia, whereas 2(16.7%) only had strabismic amblyopia, the prevalence of amblyopia and its types are shown in Fig. 1.

There were 3(25%) of amblyopic firstly diagnosed in this study, while 9(75%) of them were diagnosed before, 8 (88.9%) of those who previously diagnosed were diagnosed by ophthalmologist, whereas 1(11.1%) was diagnosed by G.P. There were 4(44.4%) were in a regular visit, 3(33.3%) of them were on a regular visit for sometimes and 2(22.2%) of them didn’t visit for follow up. Of those who previously diagnosed, 6(66.7%) were prescribed for patching technique, while 3(33.3%) of them were not, 2(33.3%) of those who prescribed patching technique did not meet compliance, 2 (33.3%) answered yes, and 2(33.3%) said sometimes. This distribution of medical diagnosis for those with amblyopia is shown in Table 1.

The demographics of amblyopia patients’ family were investigated, regarding father education, there were 2 (16.7%) had an elementary education, 1(8.3%) had intermediate education, 5(41.7%) had high school education, while 4 (33.3%) of them had a university education. Regarding mother education, there was 1 (8.3%) illiterate mother, 1 (8.3%) mother could write and read, mothers with elementary school and university education represented 2(16.7%) for each, while mothers with intermediate and high school represented 3(25%) for each. There were 5(41.7%) of fathers were retired, 1(8.3%) had a military job, 3(25%) had a civilian job and 3(25%) were teachers. 10 (83.3%) of mothers were

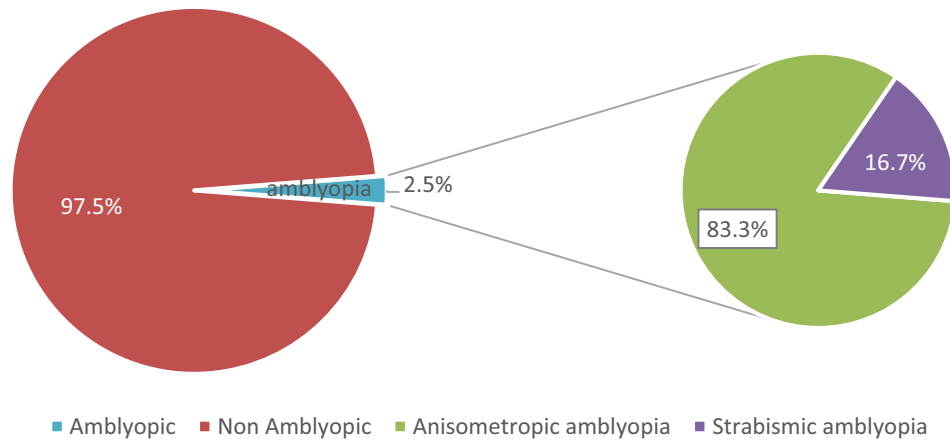


Fig. 1. Prevalence of amblyopia and its types of participants.

Table 1. Distribution of medical diagnosis data for those with amblyopia.

Medical diagnosis	Patients with amblyopia	
	No. (n = 12)	%
The first time he gets diagnosed		
■ First time (in this study)	3	25.0%
■ Diagnosed before	9	75.0%
Who diagnosed amblyopia first time (n = 9)		
■ G.P.	1	11.1%
■ Pediatric Doctor	0	0.0%
■ Optometrist	0	0.0%
■ Ophthalmology Doctor	8	88.9%
Specialized follow-up visit after diagnosis (n = 9)		
■ Regular visit	4	44.4%
■ Regular visit for sometime	3	33.3%
■ No visit	2	22.2%
Prescribed patching technique (n = 9)		
■ Yes	6	66.7%
■ No	3	33.3%
Compliance with patching (n = 6)		
■ Yes	2	33.3%
■ Sometime	2	33.3%
■ No	2	33.3%

Table 2. Distribution of demographics of amblyopic patients' family.

Family data	Patients with amblyopia	
	No. (n = 12)	%
Father education level		
■ Elementary school	2	16.7%
■ Intermediate school	1	8.3%
■ High school	5	41.7%
■ University	4	33.3%
Mother education level		
■ Illiterate	1	8.3%
■ Write and read	1	8.3%
■ Elementary school	2	16.7%
■ Intermediate school	3	25.0%
■ High school	3	25.0%
■ University	2	16.7%
Father job		
■ Retired	5	41.7%
■ Military job	1	8.3%
■ Civilian job	3	25.0%
■ Teacher, education	3	25.0%
Mother job		
■ Housewife	10	83.3%
■ Teacher, education	2	16.7%
Family monthly income		
■ 7000–14,000	3	25.0%
■ 15,000–19,000	2	16.7%
■ 20,000–25,000	6	50.0%
■ More than 25,000	1	8.3%

housewives, 2 (16.7%) only were teachers. There were 3(25%) of families had 7000–14,000 SR monthly income, 2(16.7%) had a monthly income of 15,000–19,000 SR, while 6(50%) had 20000–25000SR and 1 (8.3%) only had more than 25,000 SR monthly income. This is shown in [Table 2](#).

The effect of amblyopia on the patients were evaluated, and it was found that; amblyopia affected the academic performance of 3(25%) only of them, students didn't mention how it affected their performance. there was 1(8.3%) stated that amblyopia affected his social and physical issues, while 9(75%) answered no effect, however 2(16.7%) of them said maybe. There were 2(16.7%) thought that amblyopia would affect their future life as a doctor, while 8(66.7%) negated that and 2(16.7%) weren't sure and said maybe. 5(41.7%) thought that amblyopia would affect their choices as being a doctor, 4 (33.3%) said no, and 3(25%) of them said maybe, [Table 3](#).

Regarding the effect of amblyopia on the academic performance, the mean \pm SD of GPA for amblyopic patients was 3.7 ± 0.8 , while for healthy students the mean \pm SD was 3.8 ± 0.7 , there was no significant difference (P -value = 0.5), [Table 4](#), but mean rank of GPA for amblyopic students was lower than the mean rank of GPA for non-amblyopic, [Fig. 2](#).

The correlation between the presence of amblyopia and several factors were estimated. Regarding past history of other ocular disorder, there was a significant difference (P -value = 0.008) between amblyopic and non-amblyopic. Regarding previous eye surgery, family history of eye disorder and previous eye examination, there were no significant differences between amblyopic and non-amblyopic, [Table 5](#).

Discussion

The present study was established to evaluate the prevalence of amblyopia among male medical students, where all previous studies were performed on children and the few studies that performed on adults did not focus on medical students. Also, we aimed to find out the effect of amblyopia on the academic performance of medical students. By inves-

Table 3. Students' perception of effect of amblyopia on their life.

Effect of amblyopia	Patients with amblyopia	
	No (n = 12)	%
Effect of amblyopia on academic performance		
■ Yes	3	25.0%
■ No	9	75.0%
Effect of amblyopia on social and psychological issue		
■ Yes	1	8.3%
■ No	9	75.0%
■ Maybe	2	16.7%
Effect on future life as doctor		
■ Yes	2	16.7%
■ No	8	66.7%
■ Maybe	2	16.7%
Do you think amblyopia will affect choice speciality for you as doctor		
■ Yes	5	41.7%
■ No	4	33.3%
■ Maybe	3	25.0%

Table 4. The effect of amblyopia on academic performance of participants.

GPA	Amblyopic	Not amblyopic	P-value
Minimum	2.3	1.7	0.555
Maximum	4.6	5.0	
Mean	3.7	3.8	
SD	0.8	0.7	
Median	3.9	3.9	

Investigating the prevalence of amblyopia among the participants of this study, it was found that there were 12(2.5%) only had amblyopia.

Our findings agreed with the findings of previous studies,⁴⁻⁶ where the prevalence of amblyopia was found to range from 1% to 5% in adults. In Australia, the prevalence among adults was 3%.^{4,7} A study from Germany²³ showed that prevalence of amblyopia in older participants whose age ranged from 40 to 44 years was higher than younger participants whose age was 35-39 years.

Those with amblyopia in this study had either anisometropic amblyopia or strabismic amblyopia; the most common type was anisometropic amblyopia which repre-

Table 5. Correlation between various factors and presence of amblyopia.

Family & medical history	Amblyopic N (%)	Not Amblyopic N (%)	P-value
<i>History of other ocular disorder</i>			
Yes	10 (83.3%)	208 (44.6%)	0.008
No	2 (16.6%)	258 (55.36%)	
<i>Previous eye surgery</i>			
Yes	1 (8.3%)	21(4.5%)	0.5
No	11 (91.7%)	445 (95.5%)	
<i>Family history of eye disorders</i>			
Yes	5 (41.7%)	173 (37.1%)	0.7
No	7 (58.3%)	293 (62.87%)	
<i>Previous eye examination</i>			
Yes	7 (58.3%)	193 (41.4%)	0.2
No	5 (41.7%)	273 (69.6%)	

sented 83.3% of amblyopic patients. In an Iranian study, which was performed on students aged from 9 to 15 years,³ it was reported that the prevalence of anisometropic amblyopia was more common in amblyopic cases (36.36%) compared to (22.73%) of strabismic amblyopia.

Most of the amblyopic patients (75%) in this study diagnosed before the current study, the large majority of them (88.9%) were diagnosed by an ophthalmologist.

Only 44.4% of the patients who previously were diagnosed, compliance with a regular visit, while 22.2% reported that they did not follow-up in regular visits. The large majority of them (66.7%) were prescribed for patching technique. However 33.3% only were compliance to patching.

By investigating the perception of students about the effect of amblyopia on their life, 75% of amblyopic patients negated that amblyopia affected their academic performance or their social and physical issue. The large majority of patients 66.7% did not think that amblyopia will affect their future lives as they are doctors, but 41.7% thought that amblyopia would affect their choice for spatiality.

Regarding the academic performance of patients and healthy participants, there was no significant difference (P-value = 0.5) between both groups, where the mean GPA of amblyopic was 3.7, while the mean of non-amblyopic was

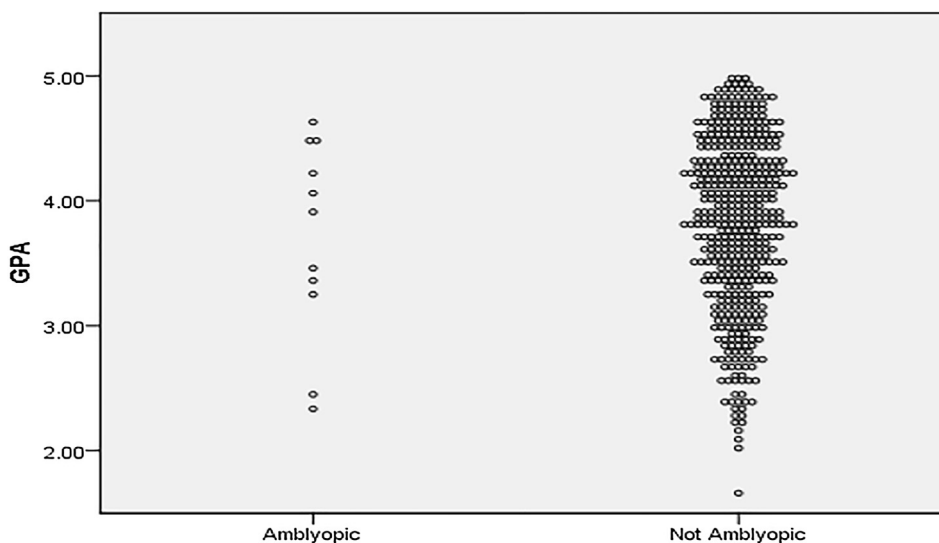


Fig. 2. The distribution of GPA between amblyopic and non-amblyopic.

3.8. The history of other ocular disorder significantly differed between the two groups (P-value = 0.008), where most of amblyopic (83.3%) had a history. Regarding previous eye surgery, family history of eye disorders and previous eye examination, there were no significance differences between the two groups.

Conclusion

Amblyopia was found in 2.5% of male medical students which is similar to the prevalence of previous studies, and the most common type was anisometropic amblyopia. Amblyopia was found to influence the choice of specialty the most, however its effect on social and physiological issue and future life as a doctor were found to be low and no significant effect found regarding academic degrees. There was a significance relation between the history of suffering ocular disorders and amblyopia, which was significantly more prevalent in patients. There was a low care for follow up and diagnosis. Increasing knowledge about amblyopia is recommended, other studies should be established to investigate the prevalence and effect of amblyopia as this is the only study was performed to investigate the prevalence in adults as all studies focused on children.

Financial disclosure

The authors have no proprietary or commercial interest in any of the materials discussed in this article.

Conflict of interest

The authors declared that there is no conflict of interest.

Acknowledgements

We have to express our appreciation to the College of Medicine at King Khalid University which assisted during the process of this research. We are also grateful to Dr. Faraj Shehata for assistance with data analysis, and Abdulla M. Assiri for assistance with examine the participants.

References

- Braverman Rebecca S. Introduction to amblyopia. *Am Acad Ophthalmol* 2015 <https://www.aao.org/pediatric-center-detail/amblyopia-introduction>.
- Webber AL, Wood J. Amblyopia: prevalence, natural history, functional effects and treatment. *Clin Exp Optom* 2005;**88**(6):365–75.
- Khalaj M, Zeidi IM, Gasemi MR, Keshtkar A. The effect of amblyopia on educational activities of students aged 9–15. *J Biomed Sci Eng* 2011;**4**:516–21.
- Attebo K, Mitchell P, Cumming R, Smith W, Jolly N, et al. Prevalence and causes of amblyopia in an adult population. *Ophthalmology* 1998;**105**:154–9.
- Groenewoud JH, Tjiam AM, Lantau VK, Hoogeveen WC, de Faber JT, et al. Rotterdam AMblyopia screening effectiveness study: detection and causes of amblyopia in a large birth cohort. *Invest Ophthalmol Vis Sci* 2010;**51**:3476–84.
- Von Noorden GK, Campos EC. Patching regimens. *Ophthalmology* 2004;**111**:1063.
- Brown SA, Weih LM, Fu CL, Dimitrov P, Taylor HR, McCarty CA. Prevalence of amblyopia and associated refractive errors in an adult population in Victoria, Australia. *Ophthalmic Epidemiol* 2000;**7**:249–58.
- Aldebasi YH. Prevalence of amblyopia in primary school children in Qassim Province, Kingdom of Saudi Arabia. *Middle East African J Ophthalmol* 2015;**22**(1).
- Al-Assaf A, Fatani R. Vision screening of preschool children in Riyadh. *Saudi J Ophthalmol* 1994;**8**:9–14.
- Abolfotouh M, Aheem Y. Ocular disorders among school boys in a high altitude area of Saudi Arabia. *Saudi J Ophthalmol* 1994;**8**:20–4.
- Al-Faran MF. Prevalence of ocular disorders among school boys in five villages in Al-Baha Region. *Ann Saudi Med* 1992;**12**:3–7.
- Kahn MU, Hossain MA, Abu-Zeid H, Eid O. Prevalence of eye problems and visual defects in school children of Abha. *Saudi Bull Ophthalmol* 1989;**4**:181–4.
- Al-Tamimi ER, Shakeel A, Yassin SA, Ali SI, Khan UA. A clinic-based study of refractive errors, strabismus, and amblyopia in pediatric age-group. *J Family Commun Med* 2015;**22**(3):158–62.
- Rahi J, Logan S, Timms C, Russell-Eggitt I, Taylor D. Risk, causes, and outcomes of visual impairment after loss of vision in the nonamblyopic eye: a population-based study. *Lancet* 2002;**360**:597–602.
- Chua B, Mitchell P. Consequences of amblyopia on education, occupation, and long term vision loss. *Br J Ophthalmol* 2004;**88**:1119–21.
- Pediatric Eye Disease Investigator Group. A randomized trial of atropine vs patching for treatment of moderate amblyopia in children. *Arch Ophthalmol* 2002;**120**:268–278.
- Neumann E, Friedman Z, Abel-Peleg B. Prevention of strabismic amblyopia of early onset with special reference to the optimal age for screening. *J Pediatr Ophthalmol Strabismus* 1987;**24**:106–10.
- Daw NW. Critical periods and amblyopia. *Arch Ophthalmol* 1998;**116**:502–5.
- Scott WE, Dickey CF. Stability of visual acuity in amblyopic patients after visual maturity. *Graefe's Arch Clin Exp Ophthalmol* 1988;**226**:154–7.
- Quah BL, Tay MT, Chew SJ, Lee LKA. study of amblyopia in 18–19 year old males. *Singapore Med J* 1991;**32**:126–9.
- Epelbaum M, Milleret C, Buisseret P, Dufier JL. The sensitive period for strabismic amblyopia in humans. *Ophthalmology* 1993;**100**:323–7.
- Flynn JT, Schiffman J, Feuer W, Corona A. The therapy of amblyopia: an analysis of the results of amblyopia therapy utilizing the pooled data of published studies. *Trans Am Ophthalmol Soc* 1998;**96**:431–53.
- Elflein HM, Fresenius S, Lamparter J, et al. The prevalence of amblyopia in Germany. *Deutsches Ärzteblatt International Dtsch Arztebl Int* 2015;**112**:338–44.