RESEARCH ARTICLE

PREVALENCE OF MYOPIA AMONG ADOLESCENTS AT KING ABDUL-AZIZ MEDICAL CITY, RIYADH, SAUDI ARABIA

Abdulaziz Alhawas[1], Afaf Moukaddem[2], Nouf Hajaj Alharbi[3], Alaa Mohammed Alzamil[3], Asrar Hmad Alrashidi[3] and Alaa Abdulrahman Alnamlah[3]

1 King Abdulaziz Medical city, Riyadh,Saudi Arabia.
2. King Saud bin Abdulaziz University for Health Sciences, Riyadh,Saudi Arabia.
3. Ministry of Health, Riyadh,Saudi Arabia.

……………………………………………………………………………………………………....

Manuscript Info

…………………………..

Abstract

………………………………………………………………………………

Introduction: Myopia or near sightedness is a refractive error in which the optical power of the eye is too strong for the equivalent axial length. As the prevalence of nearsightedness is increasing worldwide, the severity of its effect is also expected to be on the rise.

Purpose:to identify the magnitude of myopia among adolescents visiting King Abdul-Aziz Medical City, a tertiary care setting in Riyadh, acknowledge the extent and severity of myopia among adolescents, identify severity of myopia with respect to age and gender and determine which eye is more affected by myopia.

Methods: this was a retrospective cross-sectional study at KAMC-R in which charts of adolescent patients between (12-18 years old) without any systemic disease or congenital anomaly who visited the ophthalmology clinic between January 2016 and December 2016 was reviewed & prevalence of myopia was reported.

Conclusion: There is high prevalence of myopia among younger participants predominately 12 years old and it was estimated as 40% in right eye and 38% in left eye. Also, highest prevalence of hyperopia was found among younger participants specially 12 years old which was estimated as 32% in right eye and 34% in left eye. There was statistically significant difference between prevalence of myopia and hyperopia and age group, younger ages were more prominent to have myopia and hyperopia.

……………………………………………………………………………………………………....

Introduction:-

Myopia or near-sightedness is a refractive error in which the optical power of the eye is too strong for the equivalent axial length. Light rays from an object entering a myopic eye are converged and focused in front of the retina rather than on the retina (1). As the prevalence of nearsightedness is increasing worldwide, the severity of its effect is also expected to be on the rise. Myopia is a common refractive error affecting about one-third of the US population, but the prevalence ranges from as high as 90% in Taiwan University students to below 3% in Nepal. Generally, the prevalence of myopia is highest in Asian children (2). Some studies show that females have a greater prevalence of

234

Corresponding Author:- Abdulaziz Alhawas
Address:- King Abdulaziz Medical city, Riyadh,Saudi Arabia.

myopia, but other studies report a similar prevalence between sexes (3). Another study reported that the prevalence of myopia in young adolescents is growing virtually over many years and today reaches 10−25% and 60−80%, respectively, in industrialized populations of the West and East (4). In a twin cohort study in the UK that used age of use of first spectacles to calculate age of onset of myopia, 57.8% reported age of onset before 17 years old. Out of the 42.3% who reported myopia onset after age 17, 32.1% developed myopia before the age of 40, and only 10.2% started wearing spectacles after 40 years of age (5). Once a person becomes myopic, several vision changes occur, resulting in the development of myopia, the Study of the Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error in the USA reported an average annual myopia progression between ages 6 and 14 of −0.39 D (±0.32 D) with over 74% of the participants having myopia progression >-0.25 (6). The majority of studies report that over 60% of myopia is the early onset type also called juvenile or school myopia, starting between 9 and 11 years of age which increases throughout the early teenage years. The prevalence of myopia among pre-school children at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia is 2.5% (7). while the Prevalence of myopia is 5.7% among Adolescents at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia (8).

Myopia is affected by both natural variables and hereditary inclination (9). Numerous studies have shown that environmental factors play essential roles in visual and refractive growth such as the amount of work (10), reading habits (11), use of computer, and spending time outdoors. One study suggests that increasing time in outdoor activities may be an easy way to reduce the progression of myopia in children and adolescents. Another study demonstrated that children who spent more period outside have less chance to be myopic, regardless of how much work they do, or even if they have family history of myopia. It has been suggested that the protective mechanism responsible for this association is the fact that the more time spent outdoors -stimulates the release of dopamine from the retina, which in return prevents increased axial elongation, which is the foundational structure of near-sightedness (12-13).

 Myopia is the main cause of sightlessness or lack of vision and it is a significant refractive error that may lead to disability & can affect a person's quality of life. In children and adolescents, myopia and corresponding visual impairments may influence development, educational and economic attainments. Higher levels of myopia are associated with other visual impairments such as glaucoma, cataracts, atrophy and retinal detachment (14).
We estimated the prevalence of myopia to measure the burden of this disease in adolescents. In case of large numbers of patients with myopia more staffing and refractive correction surgeries will be required. Also, myopia is the most common cause of vision loss if uncorrected in adolescents, that is why we are looking to estimate the prevalence of myopia in adolescents

Methods:-
This was a retrospective cross-sectional study at KAMC-R in which charts of adolescent patients between (12-18 years old) who visited the ophthalmology clinic between January 2016 and December 2016 was reviewed & prevalence of myopia was reported.

Study Area/Setting:
The study was conducted at King Abdul-Aziz Medical City (KAMC-R), Riyadh, Saudi Arabia.KAMC is one of the three most important tertiary care centers in Riyadh, Saudi Arabia. In the ophthalmology department, there are 8 busy clinics providing cares for almost 600 patients per week.
Study Subjects:
inclusion: All male and female Saudi and non-Saudi adolescents (12-18 years) who visited the ophthalmology department at King Abdul-Aziz Medical City – Riyadh between January 2016 and December 2016
Exclusion: All male and female Saudi and non-Saudi adolescents who were diagnosed to have congenital diseases or systemic diseases that affect the vision will be excluded

Study Design:
This study was observational cross-sectional (retrospective) study of a large group of adolescents, who visited the ophthalmology department at KAMC-R between January 2016 and December 2016. The cross-sectional design allowed to estimate the prevalence of myopia among this population at a single point in time, allowed to compare many different variables at the same time, and was exploratory study for further studies.

Sample Size:
The optimal sample size was calculated using Rao soft online calculator, with 95 % level of confidence, 5 % margin of error, 17.6% response distribution and 5000 population size. The recommended sample size is 249

Sampling Technique:
A Simple random sampling technique of adolescents from sampling frame was used to estimate the prevalence of myopia among adolescents at KAMC-R. It was chosen in such a way that every set of individuals has an equal chance to be in the selected sample. We used random number generator to select the sample. Our sample size is 249 and our population is 5000, generate 249 random numbers between 1 and 5000.

Data Collection Methods, Instrument Used, Measurements:
Data collection sheet was used to enter data collected and extracted form patients' charts. Data was collected by the co-investigators.

`An eye care professional diagnoses myopia after a comprehensive eye exam. A standard vision test was used, where the person is asked to read letters on a chart placed at the other end of the room. Myopia is commonly classified into three groups: mild (≤3.0 diopters), moderate (−3.00 to −6.00 diopters), and high (>6.0 diopters).`

The variables that would be included were:
- Age in years
- Gender (male / female)
- Degree of myopia in right eye degree
- Degree of myopia in left eye degree
- Severity of myopia (mild / moderate / severe)

Statistical analysis:
Statistical Package for the Social Sciences (SPSS) software was used for data entry and analysis. Descriptive statistics was used to describe the data, and categorical variables such as gender and the severity was described as frequency or percentage., Continuous variables such as age was described as mean ± SD. Logistic regression was used to compare between age and the degree of myopia. Statistical significance would be set at $p<0.05$.

Results:-
The total number of adolescents who were involved in this study was 249; Male represented about 52% Age of study subjects ranged from 12 to 18 years old with a Mean age of 13.5 and SD 1.6 years (Table 1).
Among the study sample, the prevalence rate of myopia was 40% and 38% in the right and left eyes respectively, while the prevalence rate of hyperopia was 44% and 45% in the right and left eyes respectively while the overall prevalence of myopia and hyperopia in both eyes was 39% and 44% respectively (Table2).

For the right about 37 % of males and 43% of females had myopia, 44% of males and 43%of females had hyperopia; While in the left eye about 38 % of males and 37% of females had myopia, 44% of males and 46% of females had hyperopia

There was statistically significant different between gender and suffering myopia in the right eye, females were more suffering to myopia (p value < 0.05); while there was no statistically significant different between gender and suffering myopia in the left eye and between gender and hyperopia, (p value > 0.05), (Table. 2).
In the right eye about 14% of participants had severe myopia and 6% had severe hyperopia, while in the left eye 12% of participants had severe myopia and 6% had severe hyperopia (Table 2).
The highest prevalence of myopia was found among younger participants especially 12 years old and it was estimated as 40% in right eye and 38% in left eye. Also, highest prevalence of hyperopia was found among younger participants specially 12 years old which was estimated as 32% in right eye and 34% in left eye There was statistically significant difference between prevalence of myopia and hyperopia and age group, younger ages were more suffering to myopia and hyperopia, p value < 0.05. (Table 2).

Discussion:-
The global estimation of impaired vision related to refractive error (RE) was approximately 2.3 billion people.[15]Furthermore the number of people with visual impairments due to uncorrected RE (URE) was predicted to be 101.2 million in 2010, which was a 15% increase since 1990.[16] This number is expected to double by 2020.[17]

Our study found that the overall prevalence of myopia in right eye was 40% and in left eye was 37.5%, while in both eyes was 39%. The overall prevalence of hyperopia in right eye was 44% and in left eye was 45%, while in both eyes was 45%. These findings are consistent with the findings of previous studies [18,19,20,25,26].

Our study indicated that in the right eye about 14% of participants had severe myopia and 6% had severe hyperopia, while in the left eye 12% of participants had severe myopia and 6% had severe hyperopia, Similar study conducted in Riyadh showed that the severity of myopia was 48% had mild, 10% moderate and 1% severe while the severity of hyperopia was less than 1% [18].

Our study also revealed that the highest prevalence of myopia and hyperopia was found among younger participants specially 12 years old. This findings was consistent with the findings of previous studies [19,20,25].
In our study, both myopia and hyperopia were leading types of RE (39% and 45%) respectively, which more the prevalence reported in the Caucasian population in the USA (33%–40%), Australia (17.7%), and Norway (30%).[23,28]Furthermore, our results were lower than those observed in Chinese adolescents (54%), Taiwanese schoolchildren (87%), and Australians of East Asian ethnicity (59%), Saudi Arabia 53% [18,20,22,23]. It also greater than similar studies conducted in Jordan (17%), Turkey (3.2%), Ethiopia (7.7%–10.2%), Iran (14.90%–29.3%), Tunisia (9.1%), Morocco (6.1%), and Egypt (12%).[21,24,27,28]

Limitations:-
Single center study and our study depended on patients' data who visited the ophthalmology department due to an eye problem, But the results of the study would be better if it was done on school-based data.

Recommendations/Conclusion:-
Our results show the need for school–based programs that provide a screening programs to students. There is high prevalence of myopia among younger participants predominately 12 years old and it was estimated as 40% in right eye and 38% in left eye. Also, highest prevalence of hyperopia was found among younger participants specially 12

years old which was estimated as 32% in right eye and 34% in left eye There was statistically significant difference between prevalence of myopia and hyperopia and age group, younger ages were more prominent to have myopia and hyperopia. However, there is a need for further studies to evaluate the causes and risk factors of higher prevalence of myopia in Saudi communities.

Tables
Table 1: Age and Gender of the participants (N=249)

Variables		Male Frq. (%)	Female Frq. (%)
Age	12-13	53 (41.1)	41 (34.2)
	13-14	30 (23.3)	18 (15.0)
	14-15	19 (14.7)	27 (22.5)
	15-16	16 (12.4)	16 (13.3)
	16-17	6 (4.7)	8 (6.7)
	17-18	3 (2.3)	4 (3.3)
	>18	2 (1.6)	6 (5.0)
Variables		Male Frq. (%)	Female Frq. (%)
Age	12-13	53 (41.1)	41 (34.2)
	13-14	30 (23.3)	18 (15.0)
	14-15	19 (14.7)	27 (22.5)
	15-16	16 (12.4)	16 (13.3)
	16-17	6 (4.7)	8 (6.7)
	17-18	3 (2.3)	4 (3.3)
	>18	2 (1.6)	6 (5.0)

Table 2: Prevalence of Myopia and Hyperopia According to the age, Gender and severity   in Both Right and Left Eye

Variables			Myopia Frq. (%)	Hyperopia Frq. (%)	Normal Frq. (%)	Odd Ratio (95% CI)	p-value
Age	Right eye	12-13	40 (40)	35(32.1)	19(47.5)	20.0 (12.8, 13.7)	0.05
		13-14	20 (20)	21(19.3)	7(17.5)		
		14-15	22 (22)	22(20.2)	2(5.0)		
		15-16	11 (11)	17(15.6)	4(10.0)		
		16-17	2 (2)	6(5.5)	6(15.0)		
		17-18	3 (3)	4(3.7)	0(0.0)		
		>18	2 (2)	4(3.7)	2(5.0)		
	left eye	12-13	35 (37.6)	38 (33.9)	21 (48.8)	21.0 (12.8, 13.6)	0.04
		13-14	19 (20.4)	21 (18.8)	8 (18.6)		
		14-15	23 (24.7)	21 (18.8)	2 (4.7)		
		15-16	10 (10.8)	17 (15.2)	5 (11.6)		
		16-17	2 (2.2)	6 (5.4)	6 (14.0)		
		17-18	2 (2.2)	4 (3.6)	1 (2.3)		
		>18	2 (2.2)	5 (4.5)	0 (0. 0)		
Gender	Right eye	Male	48 (37.2)	57 (44.2)	24 (18.6)	1.0 (1.76– 3.46)	0.94
		female	52 (43.3)	43.3 (109)	16 (13.3)		
	Left eye	Male	49 (38.0)	57 (44.2)	23 (17.8)	1.0 (1.76– 3.46)	0.43
		female	44 (37.0)	55 (46.2)	20 (16.8)		
severity	Right eye	Mild	64 (64.0)	65 (59.6)	-	2.0(0.49– 2.74)	0.58
		Moderate	22 (22.0)	38 (34.9)	-		
		Severe	14 (14.0)	6 (5.5)	-		
	Left eye	Mild	59 (63.4)	65 (58.0)	-	2.18 (0.49– 2.74)	0.43
		Moderate	23 (24.7)	41 (36.6)	-		
		Severe	11 (11.8)	6 (5.4)	-		

References:-
1. Eyewiki.aao.org. (2017). Myopia - EyeWiki. [online] Available at: http://eyewiki.aao.org/Myopia [Accessed 6 Apr. 2017].
2. Garner LF, Owens H, Kinnear RF, Frith MJ. Prevalence of myopia in Sherpa and Tibetan children in Nepal. Optom Vis Sci. 1999;76(5):282–5.
3. Katz J, Tielsch JM, Sommer A. Prevalence and risk factors for refractive errors in an adult inner city population. Invest Ophthalmol Vis Sci. 1997;38(2):334–40.
4. Gilmartin B1.Myopia: precedents for research in the twenty-first century.Clin Exp Ophthalmol. 2004;32(3):305-24.
5. Galvis V, Tello A, Parra M. Re: Williams et al.: Increasing prevalence of myopia in Europe and the impact of education .Ophthalmology 2015;122(7):1489-97.

6.   Jones-Jordan L, Sinnott L, Cotter S, Kleinstein R, Manny R, Mutti D et al. Time Outdoors, Visual Activity, and Myopia Progression in Juvenile-Onset Myopes. Investigative Opthalmology & Visual Science. 2012;53(11):7169.

7.   Al-Rowaily M. Prevalence of refractive errors among pre-school children at King Abdulaziz Medical City, Riyadh, Saudi Arabia.Saudi. J Ophthalmol. 2010;24(2):45-8.

8.   Al-Rowaily M. Prevalence of Uncorrected Refractive Errors among Adolescents at King Abdul-Aziz Medical City, Riyadh, Saudi Arabia. Journal of Clinical & Experimental Ophthalmology. 2010;01(03).

9.   Robert Wojciechowski. Nature and Nurture: the complex genetics of myopia and refractive error.HHS Author Manuscripts.2010;10.1111/j.1399-0004.2010.01592.x.Availablefrom: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3058260/ [Accessed 13th December 2010].

10. Saw SM, Chua WH, Hong CY, Wu HM, Chan WY, Chia KS, et al. Nearwork in early-onset myopia. Invest. Ophthalmol. Vis. Sci. 2002;43(2):332-9.

11. Gwiazda, Jane E and Hyman, Leslie and Norton . Accommodation and related risk factors associated with myopia progression and their interaction with treatment in COMET children. Invest. Ophthalmol. Vis. Sci. 2004;45(7):2143-51

12. Sherwin, Justin C and Reacher, Mark H and Keogh. The association between time spent outdoors and myopia in children and adolescents: a systematic review and meta-analysis. J Am Acad Ophthalmol . 20012;119(10):2141-51.

13. French AN1, Ashby RS, Morgan IG, Rose KA.Time outdoors and the prevention of myopia. Exp Eye Res. 2013 ;114:58-68.

14. Rahi Jugnoo S and Gilbert. Epidemiology and the world-wide impact of visual impairment in children. Pediatric Ophthalmology and Strabismus, Expert Consult-Online and Print. 2012;1.

15. Thulasiraj RD, Aravind S, Pradhan K. Spectacles for the millions addressing a priority of "VISION 2020 – The Right to Sight". Community Ophthalmol. 2003;3:19–21. Available from: http://v2020eresource.org/ content/files/spectacles_oct-03.pdf. accessed on October 2017.

16. Naidoo KS, Leasher J, Bourne RR, et al; Vision Loss Expert Group of the Global Burden of Disease Study. Global vision impairment and blindness due to uncorrected refractive error, 1990–2010. Optom Vis Sci. 2016;93:227–234.

17. Pararajasegaram R. VISION 2020-the right to sight: from strategies to action. Am J Ophthalmol. 1999;128:359–360.

18. Ali Alsaqr et al, The visual status of adolescents in Riyadh, Saudi Arabia, Clinical Ophthalmology 2018

19. Williams KM, Bertelsen G, Cumberland P, et al; European Eye Epidemiology (E(3)) Consortium. Increasing prevalence of myopia in Europe and the impact of education. Ophthalmology. 2015;122:1489–1497.

20. Lin LLK, Shih YF, Hsiao CK, Chen CJ. Prevalence of myopia in Taiwanese schoolchildren: 1983 to 2000. Ann Acad Med Singapore. 2004;33:27–33.

21. Yamamah GAN, Mohammed AM. Prevalence of visual impairment and refractive errors in children of south Sinai, Egypt. Ophthalmic Epidemiol. 2015;22:357–357.

22. French AN, Morgan IG, Burlutsky G, Mitchell P, Rose KA. Prevalence and 5-to 6-year incidence and progression of myopia and hyperopia in Australian school children. Ophthalmology. 2013;120:1482–1491.

23. He MG, Huang WY, Zheng YF, et al. Refractive error and visual impairment in school children in rural southern China. Ophthalmology. 2007;114:374–382

24. Khader YS, Batayha WQ, Abdul-Aziz SM, Al-Shiekh-Khalil MI. Prevalence and risk indicators of myopia among schoolchildren in Amman, Jordan. East Med Health J. 2006;12:434–439.

25. Matsumura H, Hirai H. Prevalence of myopia and refractive changes in students from 3 to 17 years of age. Surv Ophthalmol. 1999;44: S109–S115.

26. Giordano L, Friedman D, Repka M, et al. Prevalence of refractive error among preschool children in an urban population: the Baltimore Pediatric Eye Disease Study. Ophthalmology. 2009;116:739–746.

27. Ali A, Talha A, Elmadina AE. Refractive errors status among children examined at optical center in Khartoum state. Sudanese J Ophthalmol. 2016;8:10–13.

28. Anera RG, Soler M, de la Cruz Cardona J, Salas C, Ortiz C. Prevalence of refractive errors in school-age children in Morocco. Clin Exp Ophthalmol. 2009;37:191–196.