ORIGINAL ARTICLE

To study the association of risk factors associated with childhood myopia

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Abstract:

Purpose: To analyze various risk factors associated with severity of childhood myopia

Place of study: Out patient department of Ophthalmology in Dow University of Health Science, Dow International Medical College Karachi.

Duration of study: The duration of the study was from 1st December 2017 till 1st December 2018.

Type of study: Cross sectional Study

Materials and Methods: Subjects were selected randomly from the out patient department between the age range of 5 to 15 years of both genders having myopia of more than 1DS at least in both eyes and with absence of any astigmatism observed on auto refractometer. They then underwent cycloplegic refraction with instillation of cyclopentolate eye drops every 10 minutes for 30 minutes. They were divided into 3 groups based on their myopia; those having less than -3DS, those between the range of -3DS to -6DS and those having high myopia of power more than -6DS. Their parents were asked to fill a questionnaire which had questions regarding the daily routine such as screen time, birth history in terms of birth weight, time spent doing near work, parental myopia, ethnicity etc.

Results: There was no significant association seen for myopia and parental myopia, BMI, time spent reading, birth weight, ethnicity however there was a significant association was found between myopia and time spent on mobile, TV, laptop and other Visual Display Units etc (P-value =0.001 < 0.05)

Keywords: Myopia, cycloplegic refraction, visual display units, amblyopia.

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Introduction:

Myopic refractive error continues to be on the rise it has been estimated to be one the leading cause of blindness with a prevalence of 80 to 90% in some populations.[1-3] In another study conducted in Taiwan the prevalence of myopia was observed in 84% of high school students.[4] Various studies have proven that the occurrence of myopia in children leads to a more rapid progression as opposed to myopia occurring in adults therefore it is imperative to diagnose myopia and to correct it as early as possible to prevent the onset of amblyopia.[5,6,7]

Myopia has been associated with various risk factors such as screen time more than 3-hours, parental myopia, less sunlight exposure, bottle fed babies and excessive near work in study conducted in Ireland.[8] Another study in Poland proved myopia and its relationship with environmental factors such day light exposure, diet, sedentary lifestyle and higher education.[9]

In a study conducted in Pakistan the prevalence of myopia was estimated to be 36.5% and although this is less as compared to the rest of the world the probable reason may be the lack of resources for effective eye checkup hence many people go undetected.[10]

Table-1 Descriptive statistics for demographics :

Characteristics	N = 125 (%)
Age in years (Mean ± SD)	12.16 ± 2.6
Birth Weight	
Low	05 (04.0%)
Normal	120 (96.0%)
Gender	
Male	63 (50.4%)
Female	62 (49.6%)
Parental Myopia	
None	58 (46.4%)
One	44 (35.2%)
Both	23 (18.4%)
Myopia	
< -3	77 (61.6%)
-3 to -6	38 (30.4%)
> -6	10 (08.0%)
BMI	
Low	56 (44.8%)
Normal	69 (55.2%)
Mobile Used (Hours)	
< 1	56 (44.8%)
1 - < 3	56 (44.8%)
3 - < 5	11 (8.8%)
> 5	02 (1.6%)
Reading Time (Hours)	
4 - < 6	20 (16.0%)
6 - < 8	51 (40.8%)
8 - < 10	43 (34.4%)
10 - < 12	11 (8.8%)
Ethnicity	
Urdu Speaking	55 (44.0%)
Sindhi	36 (28.8%)
Punjabi	14 (11.2%)
Pathan	20 (16.0%)

According to our knowledge there has been no study conducted in Pakistan that has analyzed the risk factors associated with myopia. We aim to educate the public regarding risk factors associated with myopia so as to detect it early to delay its progression. Timely intervention in the correction of refractive errors will lead to improved vision and hence a better quality of life.

Material and Methods:
This study was conducted in the eye out patient department of Dow University of Health Science. All patients underwent visual acuity assessment subjectively using auto refractometer and Snellens chart. Those found to have a best corrected visual acuity of less than 6/6 and with a myopic refractive error of at least 1DS or more in both eyes were analyzed further using cycloplegic refraction with cyclopentolate eye drops 1% instilled every ten minutes for 30-minutes followed with retinoscopy by two skilled optometrist. Participants selected were aged between 5 to 15 years and included both genders. Those having myopia less than 1DS or any level of astigmatisim or those with any other abnormality that could lead to induced myopia such as cataract, lens dislocation, keratoconus, scleral buckling were excluded from the study. Myopia was categorized as mild less than -3DS, moderate -3DS to -6SD and severe which was more than -6DS. The subjects along with their parents were then questioned regarding the child's daily routine which included total hours of near work comprising of reading, doing homework etc, total screen time(mobiles, TV, laptops) during the day, birth weight, parental myopia if present at all and if so then involvement of one or both parents was inquired, total Body Mass Index calibrated as weight(kg)/height(cm2), ethnicity which was categorized as Urdu speaking, Pathan, Sindhi and Punjabi and birth history in terms of birth weight. The date was entered in a questionnaire and was analyzed using SPSS software 21.

Statistical Analysis: The data was analyzed on IBM SPSS version 21.0 and the results were presented as Mean ± SD for Age, frequency and percentages for birth weight, gender, parental myopia, myopia, BMI, duration of mobile used, reading time and ethnicity. Statistical association were performed between Myopia with multiple factors like birth weight, gender, parental myopia, BMI, mobile used, reading time, ethnicity using chi-square test. A p-value of 0.05 or less was considered statistically significant. Graphs were made between myopia with parental myopia, reading time, time spent on mobiles, TV, laptops etc and ethnicity.

Table-2: Relationship of Myopia with Birth weight , Gender, Parental Myopia, BMI, Mobile Used, Reading Time, Ethnicity

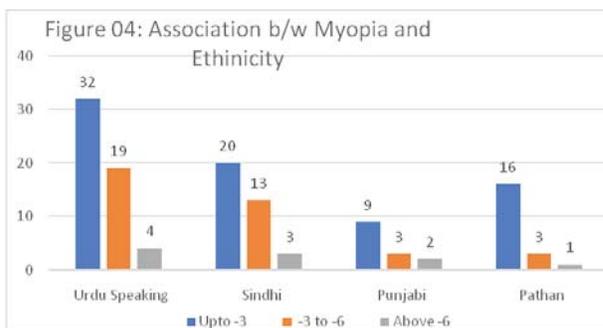| Characteristics	Myopia			Total	P-Value
	Upto -3 (n=77)	-3 to -6 (n=38)	Above -6 (n=10)		
Birth Weight					
Low	03 (60.0%)	01 (20.0%)	01 (20.0%)	05	0.50~
Normal	74(61.7%)	37 (30.8%)	09 (07.5%)	120	
Gender					
Male	37 (58.7%)	20 (31.7%)	06 (09.5%)	63	0.70
Female	40 (64.5%)	18 (29.0%)	04 (06.5%)	62	
Parental Myopia					
None	39 (67.2%)	15 (25.9%)	04 (06.9%)	58	0.07~
One	30 (68.2%)	11 (25.0%)	03 (06.8%)	44	
Both	08 (34.2%)	12 (52.2%)	03 (13.0%)	23	
BMI					
Low	40 (71.4%)	13 (23.2%)	03 (05.4%)	56	0.10
Normal	37 (53.6%)	25 (36.2%)	07 (10.1%)	69	
Mobile Used (Hours)					
< 1	37 (66.1%)	09 (16.1%)	10 (17.9%)	56	0.001**
1 - < 3 hours	34 (60.7%)	22 (39.3%)	0 (0.0%)	56	
3 - < 5 hours	05 (45.5%)	06 (54.5%)	0 (0.0%)	11	
> 5	01 (50.0%)	01 (50.0%)	0 (0.0%)	02	
Reading Time (Hours)					
4 - < 6	14 (70.0%)	04 (20.0%)	02 (10.0%)	20	0.30~
6 - < 8 hours	27 (52.9%)	19 (37.3%)	05 (09.8%)	51	
8 - < 10 hours	26 (60.5%)	14 (32.6%)	03 (07.0%)	43	
10 - < 12 hours	10 (90.9%)	01 (9.1%)	0 (0.0%)	11	
Ethnicity					
Urdu Speaking	32 (58.2%)	19 (34.5%)	04 (07.3%)	55	0.50~
Sindhi	20 (55.6%)	13 (36.1%)	03 (08.3%)	36	
Punjabi	09 (64.3%)	03 (21.4%)	02 (14.3%)	14	
Pathan	16 (80.0%)	03 (15.0%)	01 (05.0%)	20	

**Significant at 1%, ~Cells proportion > 20%
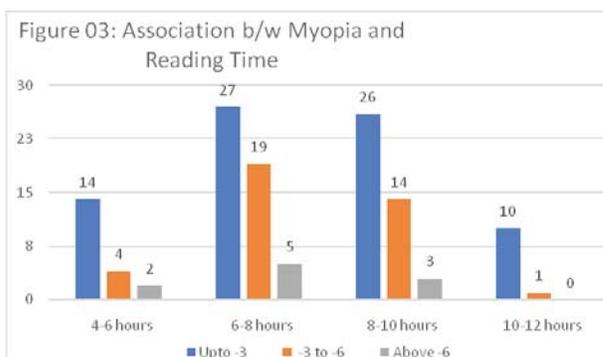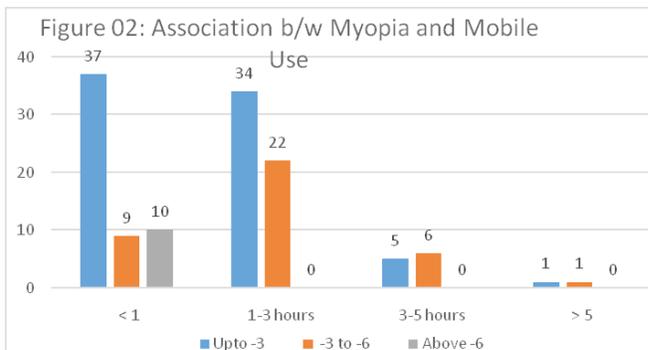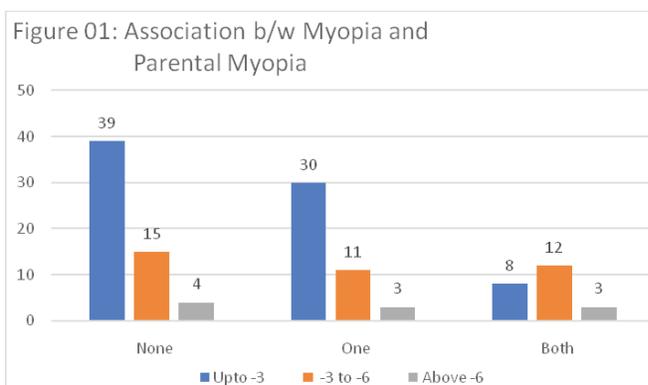
Results:

Total 125 subjects were analyzed. Table 01 describes the descriptive statistics of all respondents. Mean±standard deviation of age was (12.16±2.6) years. Gender distribution was approximately equal, males were 63(50.4%) and females were 62(49.6%). Mostly subjects were found to have normal birth weight i.e. 120(96.0%). Subjects with no parental myopia or one parent myopia are 58 (46.4%) and 44(35.2%) respectively. Subjects with Myopia < -3DS were higher 77(61.6%). Frequency of low and normal BMI were 56(44.8%), and 69(55.2%) respectively. Subjects that used mo-

biles, TV, laptops etc using less than 1 hour or between 1 to 3-hours were same i.e. 56(44.8%). Most of the subjects that spent time on reading were between 6 to 8-hours or 8 to 10-hours were 51(40.8%), and 43(34.4%) respectively. Regarding ethnicity Myopia was most commonly observed in Urdu speaking 55 (44.0%).

Table 02 describes association of Myopia with birth weight, gender, parental myopia, BMI, mobile used, reading time, ethnicity. Amongst 63 male subjects having myopia upto -3DS are higher 37(58.7%) where proportions of above -6DS are very less i.e. 09.5%. In females out of 62, 40(64.5%) have Myopia up to -3DS and there were only 06.5% who had myopia above -6 DS. There was not any significant association found for gender (P-value = 0.7). Most of the subjects are found to have normal birth weight and very less have low birth weight. Out of 120 normal birth weight subjects those that had myopia up to -3DS are 74 (61.7%) followed by -3DS to -6DS are 37(30.8%), and above -6DS are 09(07.5%) respectively. There was no significant association found for birth weight (P-value =0.5). Regarding association of parental myopia with childhood myopia it was observed that amongst 58 subjects with no parental myopia, those that had myopia up to -3DS are 39(67.2%) followed by -3DS to -6DS are 15 (25.9%), above -6DS are 04(06.9%) respectively.

Amongst 44 subjects with one parent having; those that had myopia up to -3DS are 30(68.2%) followed by -3DS to -6DS are 11(25.0%), and above -6DS are 03(06.8%) respectively. Amongst subjects with history of myopia in both parents those that had myopia up to -3DS are 08(34.2%) followed by -3DS to -6DS are 12(52.2%), above -6DS are 03(13.0%) respectively as shown in figure 01. Thus there was no significant association found for parental myopia (P-value = 0.07).

Out of 69 subjects those that had normal BMI had myopia up to -3DS were 37(53.6%) followed by -3DS to -6DS seen in 25 subjects (36.2%), and above -6DS seen in 07(10.1%) respectively. Amongst the 56 subjects with

Figure 01: Association b/w Myopia and Parental Myopia

Figure 02: Association b/w Myopia and Mobile Use

Figure 03: Association b/w Myopia and Reading Time

Figure 04: Association b/w Myopia and Ethinicity

low BMI having myopia upto-3 are 40(71.4%) followed by -3 to -6 13 (23.2%), above -6 03 (05.4%) respectively. There was no significant association found for BMI (P-value = 0.10).

Most of the subjects that used mobile, tv, laptops etc for less than 1 hour or between 1 - 3 hours and very less used mobiles or had VDU exposure for 3 to 5 or more than 5 hours. Amongst 56 patients that used mobile < 1 hour 37 (66.1%) subjects were found to have myopia up to -3DS, 09 subjects (16.1%) had myopia of -3 to -6DS while high myopia was seen who had a refractive power above -6DS was seen in 10 (17.9%) subjects respectively. Out of 56 patients using mobile and other VDUS for 1 - 3 hours having myopia up to -3DS are 34 (60.7%) followed by -3 to -6DS seen in 22 (39.3%), above -6 0 DS (0.0%) respectively as shown in figure 02. A significant association was found between myopia and time spent on mobile (P-value =0.001 < 0.05).

Most of the patients read books or studied between 6 - 8 or 8 - 10 hours and very less between 4 – 6 hours or 10 - 12 hours. Out of 51 patients who read books or studied for 6 - 8 hours: those that had myopia up to -3DS were 27(52.9%) followed by 19(37.3%) who had myopia of -3DS to -6DS while those with myopia above -6DS were 05 (09.8%) respectively. Out of 43 patients who read books or studied for 8 - 10 hours, those that had myopia up to -3DS are 26 (60.5%) followed by14(32.6%) who had myopia -3 to -6DS above -6DS was seen in 03 (07.0%) subjects respectively as shown in figure 03.

There was no significant association found for time reading (P-value = 0.30). Most of the patients having myopia are found in Urdu speaking and Sindhi ethnical groups while very less were observed in Punjabi and Pathan groups. Out of 55 Urdu speaking patients having myopia upto -3DS are higher 32 (58.2%) where proportions of above -6DS are very less i.e. 07.3%. Out of 36 Sindhi patients having myopia upto-3DS are higher 20 (55.6%) where proportions of above -6DS are very less i.e. 08.3% as shown in figure 04. There was no significant association found for ethnicity (P-value = 0.50).

Discussion:

Myopia or nearsightedness has two major causes;one due to increase in the axial length of the eye and the other due to increase in the refractive power of the eye which is based on the curvature of the cornea as well as character-

istics of the lens.[11,12] Myopia is intillay detected in school aged children as they start school and the teacher observes difficulty in reading distant alphabets and this myopia can continue to progress until adolescent stage.[13,14]

We conducted a study to assess the relationship of myopia with various factors such screen time, BMI, birth weight, parental myopia, ethnicity etc. Our study showed no significant assoiation between parental myopia and childhood myopia as opposed to a study in Australia that stated six-year-old children who had one or both parents with myopia had an increased predisposition to myopia from 7.8% to 21.4% and 22.0% respectively.[15] Regarding near work correlation with myopia there was no significant association noted as p value=0.3. This was consistent with another study conducted in Asians in China.[16,17] We also aimed to study the prevalence of myopia in different ethnic groups and found it to be the highest amongst Urdu speaking individuals but that can be accounted for the reason that most of the people presenting to the out patient department were Urdu speaking and there was no equal representation of ethnic groups as there should have been for a valid conclusion. There is no other study conducted in Pakistan comparing myopia in ethnic groups hence comparison cannot be made. We found a significant association between childhood myopia and screen time as described above and thus was similar to another study in Singapore[18] but surprisingly was contrary to a study done in Taiwan on rural children.[19] We found no significant association between myopia and BMI and this was agreeable to other studies in Myanmar and Korea.[20-22]

Limitations: The strength of our study is that this is the first of its kind done in Pakistan. The limitations however are quite a few which include a small sample size, a single location, exclusion of useful data variables such as sunlight exposure, duration of exercise, level of education, social and economic status, bottle fed versus mother fed children, premature infants versus term infants etc. Also there was a discrepancy in the history taken from the child as compared to his parents. Parents insisted on more screen time as compared to children who underestimated the duration.For a more precise study a prospective analysis should be done with a larger sample size, taking into account all the above mentioned variables.

Conclusion:

Screen time is on the rise for children and the trend has shifted from outdoor activities to indoor games in particular involving watching TV, playing video games and doing homework, assignments on laptop. A positive correlation has been proven between screen time exposure and progression in myopia hence it is imperative for us to reduce screen exposure of children and urge them to have more outdoor activities. We should have screen time exposure awareness programs conducted in schools where health personals can advise and educate the children by visiting schools.

Role and contribution of authors:
Dr Saba Alkhairy, collected the data, references and did the initial writeup

Dr Farnaz Siddiqui, helped in collecting the data and also helped in introduction writing.

Dr Asad Azeem, collected the references and also helped in introduction writing.

Dr Mazhar ul Hassan, collected the referenes and also helped in discussion writing.

Dr Arif Nayani, collected the references and also helped in result writing.

Dr Madiha Basalat, collected the data and helped in discussion writing.

Dr Sajjad Kalb e Raza, critically review the article and made the final changes

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