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## Eyesight problems in adolescent population: is it genetic or lifestyle or both - A survey-based analysis

Yoshita Guntupalli, Karthik Ganesh Mohanraj\*

Department of Anatomy, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai - 600077, Tamil Nadu, India



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### ABSTRACT

The eyes are the windows to our soul. We have been gifted with the beautiful power of eyesight to see the wonders in front of us. The eyes are the second evolved or developed unique sense organ next to olfaction in animals. For animals, it serves to locate food, and also to spot the approaching predator or prey. Apart from these aspects as far as the humans are concerned, their eyes serve several purposes apart from the said purposes. Eyes are unique and specialized to accommodate both light and dark fields, black/white and colour images, near and far objects etc. Since it is extensively used, it can become less functioning or even worse, depending on several conditions. Sadly, the eyesight problems are very common disorders which affect all age groups. There are many reasons for their occurrence. The purpose of our study is to find out the cause of eyesight problems among the adolescent population. A self-prepared questionnaire comprising ten questions was prepared and circulated among the participants. The results were collected and analyzed. 64% of participants had eyesight problems, while 36% did not have any such problems. 31% had eyesight problems since birth. Upon analyzing the results, it can be said that the prevalence of eyesight problems among adolescents is pretty high, and they are mostly caused due to lifestyle patterns.

### \*Corresponding Author

Name: Karthik Ganesh Mohanraj  
 Phone: +91 99405 45168  
 Email: karthikm.sdc@gmail.com

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mon causes of serious visual impairment in newborns (FitzPatrick and van Heyningen, 2005). Eye disorders can either be present since birth (genetic) or acquired during life due to certain habits and practices (i.e., due to lifestyle). Some genetic eye disorders include retinoblastoma, colour blindness, congenital stationary night blindness, ocular albinism, etc., (Johnson *et al.*, 2020). The diagnosis and understanding of many such genetic ocular disorders have been aided by the identification of the disease-causing chromosomal loci. Gene mapping has been done earlier to detect eyesight disorders (Rosenfeld *et al.*, 1994).

### INTRODUCTION

Eyesight problems are very common these days. They are so common to the point that they are considered almost normal. Wearing glasses is considered to be a style statement. In developed countries, malformations of the eye are among the most com-

Lifestyle-related eye disorders include diabetic retinopathy, hypertensive retinopathy, primary open-angle glaucoma, dry eye syndrome, age-related macular degeneration, age-related cataract, thyroid eye disorder and refractive errors. These are all mainly caused by improper dietary intake

and improper lifestyle (Parihar *et al.*, 2016; Sekar *et al.*, 2019). Lifestyle disorders are characterized by disharmony of the body due to an inappropriate relationship with the environment (Kumar and Kumari, 2017). Lifestyle exposure or behaviours are linked to many human illnesses (Seppan *et al.*, 2018). Examples are very wide-ranging. Causes of age-related cataract are smoking, alcohol consumption, diet and supplements as well as light exposure (Klein and Klein, 2007). Some eye disorders are age-related and occur during the later stages of life (old age). Cataract, glaucoma, diabetic radiotherapy are age-related eye disorders (Krishna and Babu, 2016). So is age-related macular degeneration. Interestingly, in a study in Singapore, these diseases were found to be linked with cognitive dysfunction (Ong *et al.*, 2012). Dry eye is a very common condition with a high prevalence among the elderly (Nandhini *et al.*, 2018).

The various factors contributing to dry eye are age, female gender, outdoor jobs, tobacco consumption, diabetes mellitus, meibomian gland disease, antiglaucoma medications and contact lens use (Subashri and Thenmozhi, 2016). It was found that American consumers spend over 100 million dollars per year towards lubricating drops (Shah and Jani, 2015). Blindness or low vision affects approximately 1 in 28 Americans older than 40 years (Thejeswar and Thenmozhi, 2015). The prevalence of visual disabilities was predicted to increase during the next 20 years, owing largely to the ageing of the population (Congdon *et al.*, 1960). Undercorrected refractive error and cataract are the leading causes of visual impairment among the Malay adult population in Singapore (Wong *et al.*, 2008). People with Retinitis Pigmentosa in the Republic of Korea were reported to be physically inactive and have more fast food than the general population (An *et al.*, 2014). Myopia is a growing public health problem with visual, quality of life and economic consequences (Sriram *et al.*, 2015). The prevalence rate and severity of myopia are increasing in different parts of the world, especially in Asia. However, this does in no way affect the utility of the students as utility values in myopic students were higher than those with better presenting visual activity (Saw, 2003; Keerthana and Thenmozhi, 2016).

In a study conducted among children of age between 6 to 7 years, the prevalence of myopia was less in Sydney than in Singapore though children in Sydney read more books per week (Hafeez and Thenmozhi, 2016; Pratha and Thenmozhi, 2016). This was associated with increased hours of outdoor activities in Sydney children (Rose, 2008). Com-

puter Vision Syndrome (CVS) represents a group of visual and extraocular symptoms associated with sustained use of visual display terminals (Choudhari and Thenmozhi, 2016). Headache, blurred vision and ocular congestion are the most frequent manifestations determined by long term use of gadgets (Bogdănici *et al.*, 2017). In a survey conducted among women of age 50 to 70 years, it was found that having unhealthy lifestyles as well as 2CFH alleles increased age-related macular degeneration (AMD) risk. However, unhealthy lifestyles increased AMD risk regardless of AMD risk genotype (Meyers *et al.*, 2015).

Hence, eye diseases are very common. Most articles talk either about inherited or lifestyle disorders alone. In our study, we aim to compare both and determine which factor is more likely to lead to an eye disorder.

## MATERIALS AND METHODS

The study was carried out in an online setting. A well-structured questionnaire comprising ten questions covering the socio-demographic information, knowledge, experience and perception was framed and circulated among 100 South Indian adolescents. The study involved two people, the primary investigator and the guide.

The sample size included 100 participants to which the questionnaire was circulated online. The sampling method used was simple random sampling. The data collection software used was google forms. The data was then sorted out in an Excel spreadsheet. The method of representation of each question was done using a pie chart. The statistical software used was SPSS version 23.0. The statistical analysis used was descriptive analysis represented in frequency distribution. Statistical analysis used for analyzing association was by chi square test.

## RESULTS AND DISCUSSION

From the analyzed data, it was found that the percentage of ages of participants who took up the survey, the majority of the age ranged from 16-19 years old. Sixteen years old, 13%, 17 years old, 24%, 18 years old, 27% and 19 years old participants were about 22% (Figure 1). The gender distribution of all the participants showed that female participants were 54%, and male participants were 46% (Figure 2).

In the present study, 64% of participants were suffering from eyesight problems, while 36% did not have any eyesight problems (Figure 3). According to the study by Suchi (Shah and Jani, 2015), 54.3%

were suffering from dry eyes. In (Vehof *et al.*, 2014), 9.6% suffered from dry eye disease. From the data it was seen that for

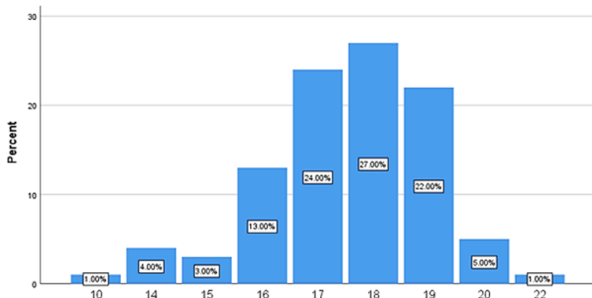


Figure 1: Bar chart shows the percentage of ages of participants who took up the survey

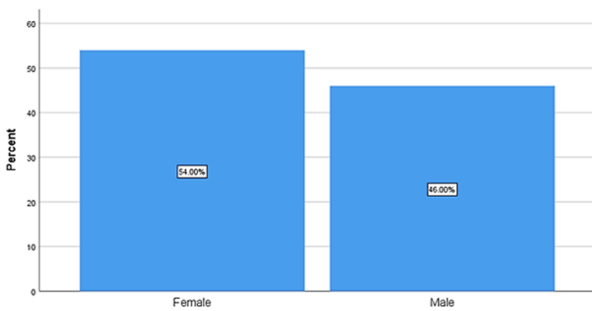


Figure 2: Bar chart shows the gender distribution of all the participants

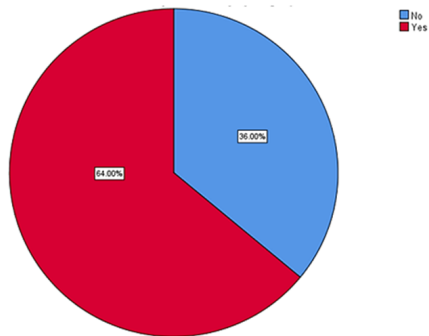


Figure 3: Pie chart shows the percentage of participants suffering from eyesight problems

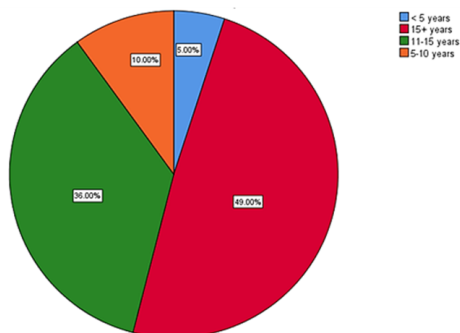


Figure 4: Pie chart shows the age at which the participants first developed eyesight problems

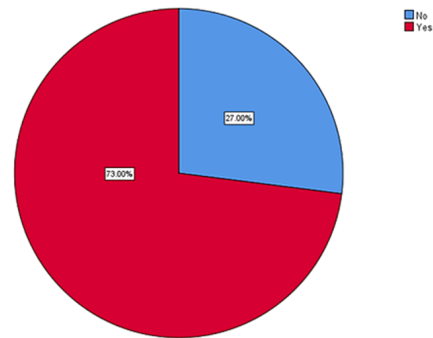


Figure 5: Pie chart shows the percentage of participants with parents or grandparents having eyesight problems

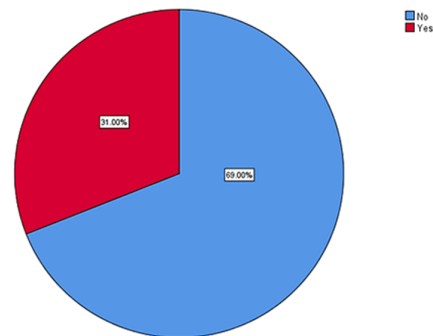


Figure 6: Pie chart shows the percentage of participants who had their eyesight problems present since birth

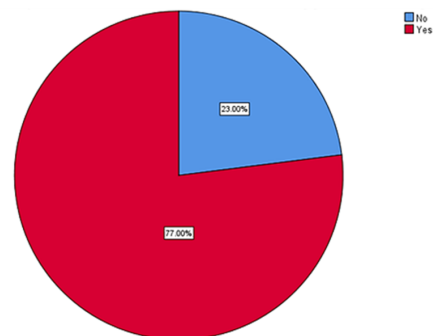


Figure 7: Pie chart shows the percentage of participants who feel that the number of youngsters wearing glasses is increasing

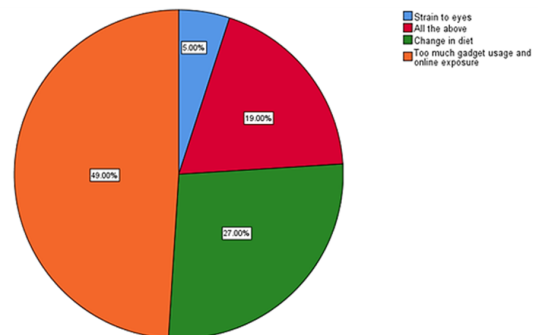


Figure 8: Pie chart shows participants' perception of the significant cause of eyesight problems

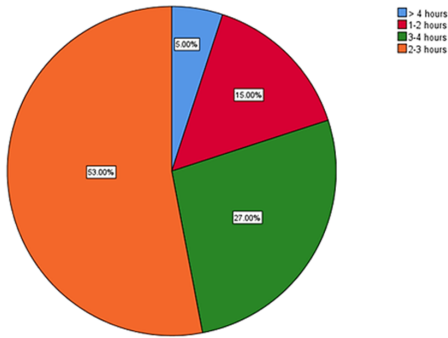


Figure 9: Pie chart shows the number of hours students spend on their gadgets

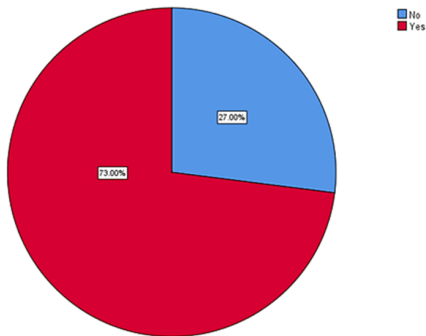


Figure 10: Pie chart shows the percentage of participants who look at their phone in the dark

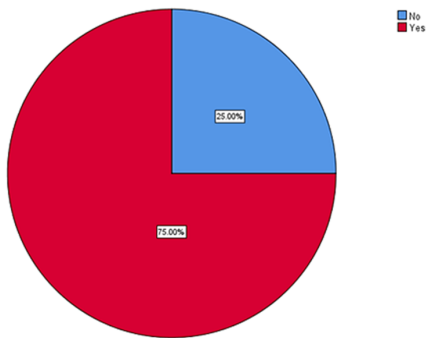


Figure 11: Pie chart shows the percentage of participants who take proper care about the lighting while reading

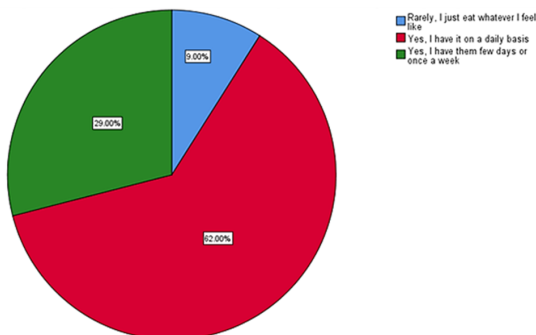


Figure 12: Pie chart shows how often participants eat healthy to combat their eyesight problems

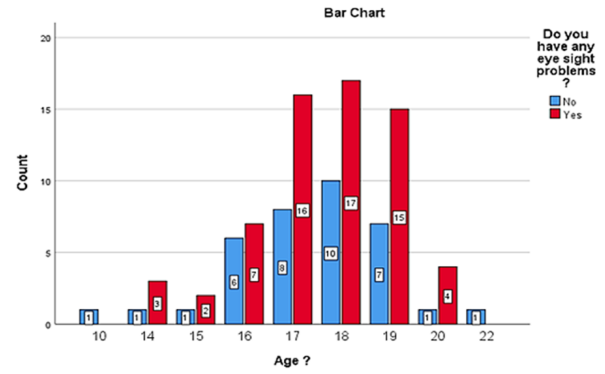


Figure 13: Bar graph showing the prevalence of eyesight problems between different ages

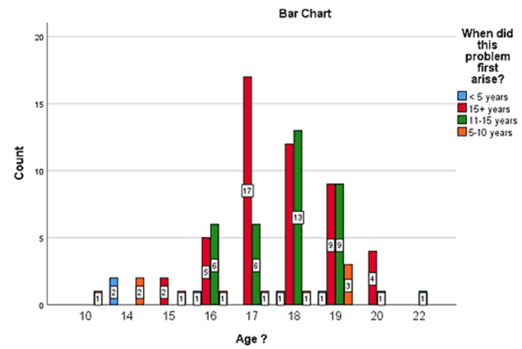


Figure 14: Bar graph showing the age at which the participants first got their eyesight problems

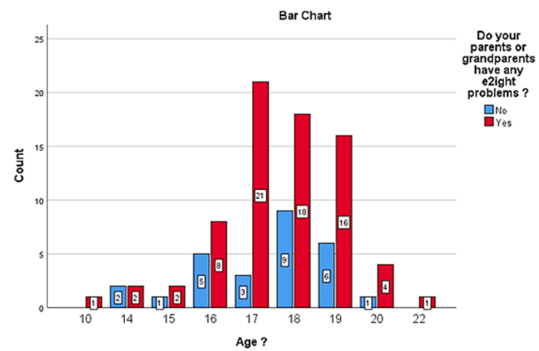


Figure 15: Bar graph representing whether participants' parents or grandparents have any eyesight issues

Figure 1, Majority of the age ranged from 16-19 years old. The X-axis represents the age distribution of participants. Y-axis represents the percentage of participants.

Figure 2, Female participants were 54%, and male participants were 46%. The X-axis represents gender. Y-axis represents the percentage of participants.

Figure 3, 64% (red) suffered from eyesight problems. 36% (blue) did not have any eyesight prob-

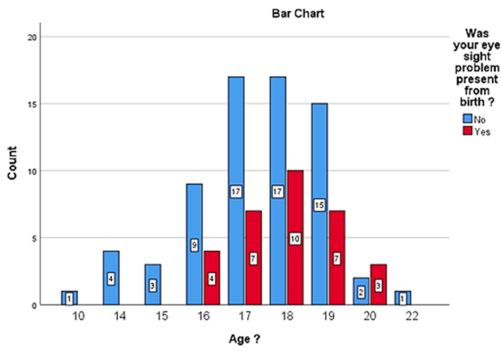


Figure 16: Bar graph showing the number of participants from different adolescent years who had their eyesight problems from birth

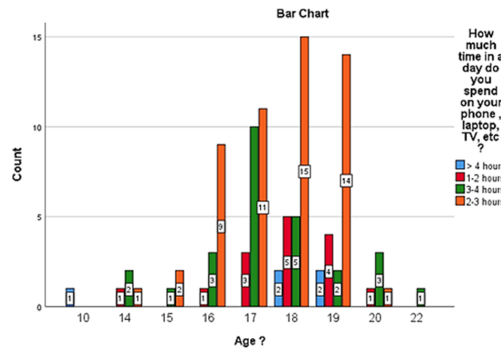


Figure 19: Bar graph showing how much time participants of different adolescent years spend on their gadgets

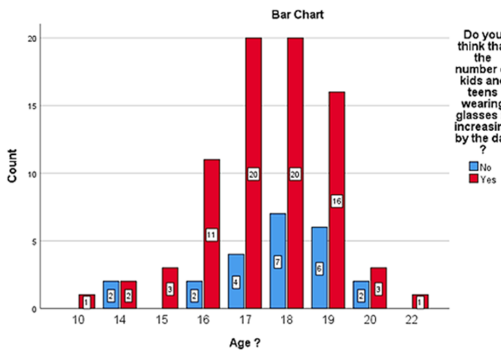


Figure 17: Bar graph showing whether participants thought that the number of teens wearing glasses is increasing by the day

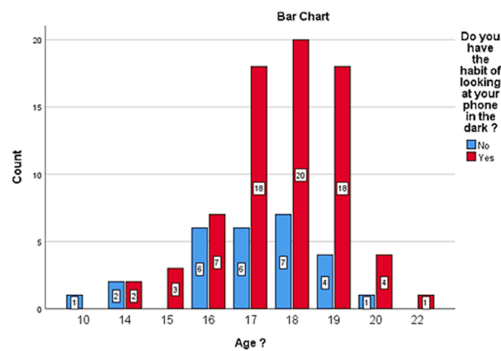


Figure 20: Bar graph showing whether participants have the habit of looking at their phone in the dark

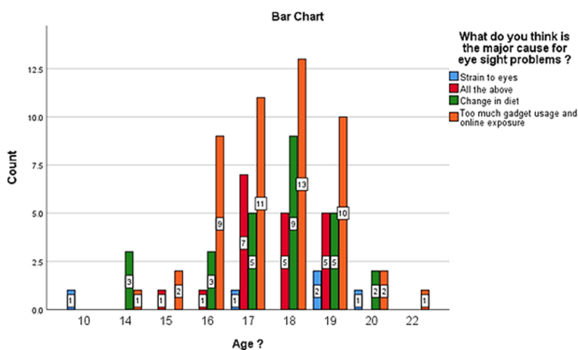


Figure 18: Bar graph showing what the participants think is the major cause of eyesight problems

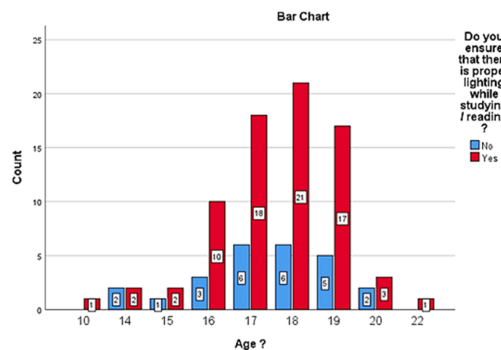


Figure 21: Bar graph showing whether participants ensured sufficient lighting while carrying out activities like reading

lems.

Figure 4, 5% (blue) had eyesight problems below the age of 5 years, 49% (red) above the age of 15 years, 36% (green) 11-15 years of age, 10% (orange) between 5-10 years of age.

Figure 5, 73% of participants had parents or grandparents with eyesight problems, while 27% (blue) did not.

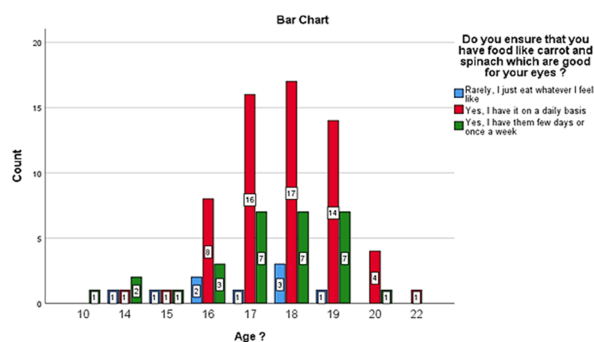
Figure 6, 31% (red) had eyesight problems since

birth, while 69% (blue) acquired it later.

Figure 7, 77% (red) think that more and more youngsters are wearing glasses while 23% (red) do not feel so.

Figure 8, 49% (orange) think due to too much gadget usage, 27% (green) due to a change in diet, 5% (blue) due to strain to the eyes and 19% (red) think all the above is a possible explanation.

Figure 9, 15% (red) spend 1-2 hours. 53% (orange)



**Figure 22: Bar graph showing whether participants from different adolescent years incorporate healthy food (good for the eyes) in their diet and how often they have it**

spend 2-3 hours. 27% (green) spend 3-4 hrs. 5% (blue) spend more than 4 hour hours on gadgets.

Figure 10, 73% (red) have the habit of looking at their phone in the dark while 27% (blue) do not have this habit.

Figure 11, 75% (red) take proper care, while 25% (blue) do not take care of the lighting.

Figure 12, 62% (red) have healthy food every day. 29% have them a few days a week. 9% do not take care about what they intake.

Figure 13, Chi square test showing  $p=0.740$  ( $p>0.05$ ) indicating statistically not significant.

Figure 14, Chi square test showing  $p=0.001$  ( $p<0.05$ ) indicating statistically significant.

Figure 15, Chi square test showing  $p=0.650$  ( $p>0.05$ ), indicating statistically not significant.

Figure 16, Chi square test showing  $p=0.590$  ( $p>0.05$ ) indicating statistically not significant.

Figure 17, Chi square test showing  $p=0.727$  ( $p>0.05$ ) indicating statistically not significant.

Figure 18, Chi square test showing  $p=0.042$  ( $p<0.05$ ) indicating statistically significant.

Figure 19, Chi square test showing  $p=0.033$  ( $p<0.05$ ) indicating statistically significant.

Figure 20, Chi square test showing  $p=0.365$  ( $p>0.05$ ) indicating statistically not significant.

Figure 21, Chi square test showing  $p=0.940$  ( $p>0.05$ ) indicating statistically not significant.

Figure 22, Chi square test showing  $p=0.799$  ( $p>0.05$ ) indicating statistically not significant.

49% of the participants eyesight problems occurred after 15 years of age, 36% it occurred between ages of 11 and 15 years, 10% it occurred between 5 to 10 years of age and 5% it occurred below five years of

age (Figure 4). According to (Meyers *et al.*, 2015), 91% suffered from early AMD.

73% of participants' parents and grandparents had eyesight problems, while 27% of participants' parents and grandparents were not suffering from any eye disorder (Figure 5). According to Shin (Ong *et al.*, 2012), older persons were at more risk of visual impairment which also resulted in cognitive impairment/dysfunction. In Suchi (Shah and Jani, 2015), the prevalence of dry eye among participants aged above 71 years was 67.3%.

69% of participants suffered from acquired eyesight problems, while 31% suffered from inherited eye disorders (Figure 6). In (Singh and Tyagi, 2018), hereditary and inflammatory diseases like AMD and Retinitis Pigmentosa were the leading cause of blindness. In (Meyers *et al.*, 2015), it was both a combination of an unhealthy lifestyle and 2 CFH risk allele, which increased AMD risk. However, an unhealthy lifestyle increased risk more (Menon and Thenmozhi, 2016).

In the present study, 77% of participants feel the number of teenagers and kids wearing glasses is increasing these days (Figure 7). 49% of participants think too much gadget usage and blue light exposure is the major cause of eyesight problems. 27% think it is due to a change in diet. 5% think it is due to greater strain to eyes while 19% feel that all the above reasons could be a possible explanation (Figure 8). According to Suchi (Shah and Jani, 2015) factors contributing to dry eyes are age, female gender, outdoor activities, tobacco consumption, diabetes mellitus and use of contact lenses.

5% of participants use their gadgets for more than 4 hours. 15% use it for 1-2 hours. 27% spend 3-4 hours on their gadgets, and 53% spend 2-3 hours (Figure 9). According to (Khuu and Hamzah, 2018), 50% participants spend more than 2 hours daily on their gadgets and the mean usage per day was found to be 284 minutes. Gadget usage has become an inevitable part of life (Samuel and Thenmozhi, 2015).

73% of participants have the habit of looking at their phone in the dark. 23% of participants avoid doing so (Figure 10). According to an article by India Today, using a phone in the dark is much more damaging. Photoreceptors respond negatively and produce a poisonous chemical which can lead to blindness (Kannan and Thenmozhi, 2016). 75% of participants ensure there is proper lighting while studying. 25% do not do so (Figure 11). According to India Today, this causes stress to the eyes and photoreceptor cells once damaged cannot be regenerated, and this results in several vision problems.

62% of participants incorporate carrots and spinach and other food items good for the eyes in their diet every day. 29% incorporate them a few days a week, while 9% are not so mindful of what they eat (Figure 12). According to (An *et al.*, 2014), people with retinitis pigmentosa have more fast food consumption and physical inactivity. 10% of the participants are 18 years of age and were not affected by eyesight problems. The chi square analysis was done between age and the prevalence of eyesight problems, which was statistically not significant as  $p=0.740$  ( $p>0.05$ ) indicating there was no association between age and the prevalence of eyesight problems (Figure 13).

17% of the participants, who are 17 years of age, experienced eyesight problems after 15 years of age and the chi square analysis between age and development of eyesight problems was statistically significant as  $p=0.001$  ( $p<0.05$ ) indicating there was an association between age and development of eyesight problems (Figure 14). 9% of the participants, who are 18 years of age, had parents or grandparents who did not suffer from eyesight problems and the chi square analysis between age and prevalence of eyesight problems among parents and grandparents was statistically not significant as  $p=0.650$  ( $p>0.05$ ) indicating there was no association between age and prevalence of eyesight problems among parents and grandparents (Figure 15).

10% of the participants, who are 18 years of age, had eyesight problems from birth and the chi square analysis between age and prevalence of eyesight problems from birth was statistically not significant as  $p=0.590$  ( $p>0.05$ ) indicating there was no association between age and prevalence of eyesight problems from birth (Figure 16). 20% of the students, who were 17 and 18 years of age were aware that the number of children wearing glasses was increasing day by day and chi square analysis was statistically not significant as  $p=0.727$  ( $p>0.05$ ) indicating there was no association between age and responses of the participants thought that the number of teens wearing glasses are increasing day by day (Figure 17).

7% of the students, who are 17 years of age, were aware that the main causes for eyesight problems were straining of the eyes change in diet and excess gadget usage. Chi square analysis was statistically significant as  $p=0.042$  ( $p<0.05$ ), indicating there was an association between age and the awareness of the main causes of eyesight problems (Figure 18).

15% of the students, 18 years of age spent an average of 2-3 hours on electronic gadgets every day, and the chi square analysis between age and average

duration of gadget usage was statistically significant as  $p=0.033$  ( $p<0.05$ ) indicating there was an association between age and average duration of gadget usage (Figure 19). 20% of the students, 18 years of age, had the habit of using electronic devices in the dark and the chi square analysis between age and usage of electronic devices in the dark was statistically insignificant as  $p=0.365$  ( $p>0.05$ ) indicating there was no association between age and usage of electronic devices in the dark (Figure 20).

21% of the students, 18 years of age ensured that there was proper lighting while studying and the chi square analysis between age and efficient lighting while studying was statistically insignificant as  $p=0.940$  ( $p>0.05$ ) indicating there was no association between age and efficient lighting while studying (Figure 21). 17% of the students, 18 years of age ensured that they had food which improved their eyesight on a daily basis and the chi square analysis between age and incorporation of healthy food in their diet was statistically insignificant as  $p=0.799$  ( $p>0.05$ ) indicating there was no association between age and incorporation of healthy food in their diet (Figure 22).

Analyzing the data obtained, it can be said that eye disorders are prevalent among adolescents, and this is mainly due to lifestyle habits. With greater sample size and by avoiding the homogenous population and regionalism, we can improve our results obtained. Lifestyle changes have impacted our health in the negative. Since we are too involved at this point to change our way of life, getting to know the causes of eyesight problems can help improve eyesight.

## CONCLUSION

Any disorder can be considered to occur by birth or acquired during the lifetime of an individual. Eyesight problems are caused due to both our lifestyle patterns and genetic factors. However, it is our way of life which is impacting our eyesight more. We have chosen our way of life and hence the problems we face. According to our study, most adolescents acquire eyesight problems after the age of 15 years due to increased gadget usage.

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The authors declare that they have no funding support for this study.

**Conflict of Interest**

The authors declare that they have no conflict of interest for this study.

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