Section: Ophthalmology

Original Research Article

ASSOCIATION OF SOME DEMOGRAPHIC AND LIFE STYLE FACTORSTO MYOPIA IN SCHOOL GOING CHILDREN

Geetanjali Pal[1], Nitin Mehrotra[2], Govind Singh Titiyal[3]

[1]*Ophthalmologist, District Hospital Pauri, Garhwal, Uttarakhand, India.*
[2]*Associate Professor, Department of Ophthalmology, Government Medical College, Haldwani, Nainital, Uttrakhand, India.*
[3]*Professor, Department of Ophthalmology and Principal, Government Medical College Rudrapur, Uttrakhand, India.*

Received *: 01/07/2025*
Received in revised form *: 15/08/2025*
Accepted *: 03/09/2025*

Corresponding Author:
Dr. Nitin Mehrotra,
Associate Professor, Department of Ophthalmology, G.M.C Haldwani, Nainital, Uttrakhand, India.
Email: drnitinmehrotra@gmail.com

DOI: 10.70034/ijmedph.2025.3.439

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 2385-2390

ABSTRACT

Background: Myopia (near sightedness) represents a significant public health concern globally, particularly among children especially in south eastern Asia. Studies across the globe suggest that genetic, environmental and life style related factors are involved in its development and progression. **Objective:** Study the association of demographic and life style related factors to myopia in school going children in hilly terrain region of northern India.

Materials and Methods: Present cross sectional study was conducted at Haldwani, Nainital on myopic children in the age group of 6-15 years. Demographic, life style and clinical attributes of each case was recorded. Association was worked out for each demographic and life style attributes with refractive error by applying appropriate statistical tests using statistical package SPSS-23.

Results: Proportion of new myopic cases was significantly more. Both male and female cases have similar chance of getting myopia. Urban children belong to middle socio economic strata in age group 13-15 years were more proportionally. Most of the cases denied leafy vegetables as menu in diet and avoided outdoor activity Maximum cases spend 3-4 hours in front of screen daily with refractive error range of 0.5-2.0 D. Refractive error was more in cases with female sex, upper socioeconomic class, 3-4 hours screen time and less outdoor activities. However, it was similar among cases under various age groups and whether they included leafy vegetables in diet or not. Significant number of old cases fall under moderate and severe category while in new one with mild myopia.

Conclusion: Children in various age groups of both sexes have similar chance of getting myopia and its magnitude. Urban children are more prone to myopic condition. Myopia progresses as screen time increases. Outdoor activities improve eye condition while use of green leafy vegetables may/may not. Extent of myopia increase as duration of symptom goes on.

Keywords: Myopia, Refractive error, Green leafy vegetables, Outdoor activity.

INTRODUCTION

Myopia (near-sightedness) represents a significant public health concern globally, particularly among children. It stands as the leading cause of visual impairment. In India its prevalence rate ranging from 2.77% to 7.4% in 5-15 year age group with higher incidence in urban areas compared to rural areas. It is projected that up to 48.14% of Indian children may develop myopia by 2050.[1] Developed regions of east and Southeast Asia exhibit disproportionately high myopia rates among propagation of myopia.[3,4] Several genes implicated in the development of high myopia have been identified, shedding light on its hereditary nature. Parents afflicted by myopia displaying increased susceptibility for myopia in children.[5,6] Numerous epidemiological studies have investigated the relationship between screen time, outdoor activities and myopia, offering valuable

insights into its prevalence and associated risk factors. Research findings suggest positive school-aged children, reaching 80-90% compared to 20-40% in many western countries.[2] The increasing prevalence of myopia, especially in children, is becoming a public health concern in India. Evidence suggests that both genetic and environmental factors are involved in development and association between increased screen time, reduced outdoor activities and higher prevalence of myopia among children.[7,8] Indoor environment as a consequence of urban locality was found potential risk factor for development of myopia.[9] In addition, there is ample literature related to the association between nutrition and my opinion the human population.[10,11] It was observed that my opus are deficient in energy intake and various nutrients that included protein, fat, vitamin B1, vitamin B2, vitamin C, phosphorus, iron, and cholesterol.[12,13] Various trace including zinc, copper, selenium, and manganese may play significant role in the pathogenesis of myopia.[14] Longer axial length (AL) was associated with higher consumption of saturated fats, cholesterol and high glycaemic load carbohydrates.[15,16] The majority of the studies arrived to conclusion that serum concentration of vitamin D is lower in individuals with myopia.[17] Vitamin A is the precursor for retinoic acid (very important in vision chemistry), studies showed no relationship between vitamin A and myopia.[10] Consumption of GLV (Green leafy vegetables) is believed to contribute to lower risk of develop in gage-related diseases, namely macular degeneration and cataract, by providing high amounts of the xanthophyll lutein and potentially other phytochemicals and minerals.[18] However, therapeutic use of green leafy vegetables in case of myopia is obscure. Some worker indirectly considered green leafy vegetables as important for proper vision.[19] We have no hesitation to say that , demographic and life style related factors shows mixed response toward myopia development and progression in studies conducted in various corner of the globe. In continuation to this, an attempt has been made here to study the association of demographic and life style related factors to myopia in school going children in hilly terrain region of northern India. Present study will aid information to arrive at some final conclusion to this important vision related issue.

MATERIALS AND METHODS

Present cross sectional study was conducted at department of ophthalmology, government medical college, Haldwani, Nainital during October, 2022 to February, 2024 after getting institutional ethical approval. Four hundred and fifty myopic children in the age group of 6-15 years visited to hospital were included in the study with consent. Patients using atropine (0.01%) eye drops, those had myopia related to collagen disorders, retinal dystrophies, or any previous ocular surgeries and/or declined consent were excluded from study. Demographic (case history, sex, locality, age, socioeconomic status), life style (use of leafy vegetables (outdoor activity, screen time) and clinical (refractive error) attributes of each cases were recorded. Association was worked out for each demographic and life style attributes with refractive error. All collected data were systematically summarized in useful manner and kept in Microsoft Excel (version 2010). Quantitative variables were presented as mean ± standard deviation, while qualitative variables were presented in percent. Data were visualized via table and suitable graphical mean (bar diagram and histogram). Appropriate statistical tests (Chi-square, student t-test and one way ANOVA) were applied to validate result derived from data using statistical package SPSS-23.Statistical significance level for all test were setat $P<0.05$.

RESULTS

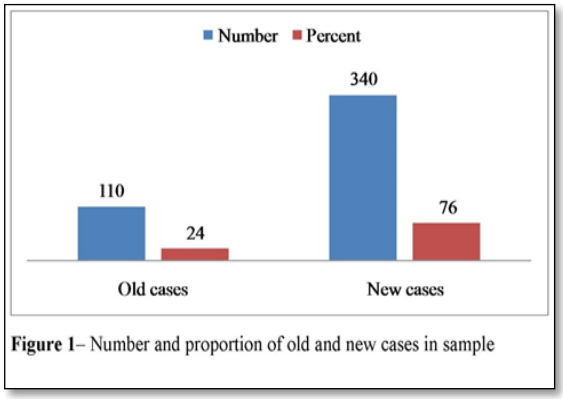

Figure 1– Number and proportion of old and new cases in sample

Proportion of new myopic cases was significantly more (p<0.0001) (Figure 1).

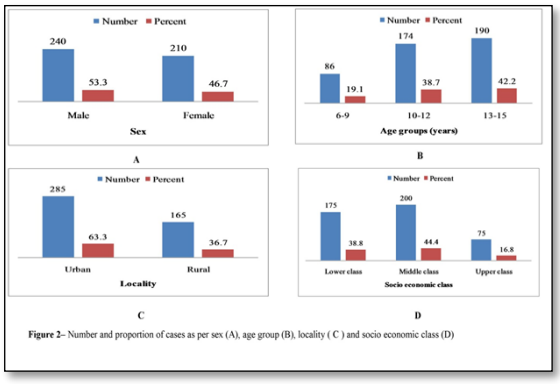

Figure 2– Number and proportion of cases as per sex (A), age group (B), locality (C) and socio economic class (D)

The difference in proportion of male and female patients in studied sample was insignificant (p=0.317).Maximum patients were in age group 13-15 years than in age groups 10-12 years and 6-9 years respectively (p<0.0001). Individuals of urban locality were more myopic than rural ones significantly (p<0.0001). The proportion of patients in middle and upper class was significantly more and less respectively (p<0.0001) (Figure 2).

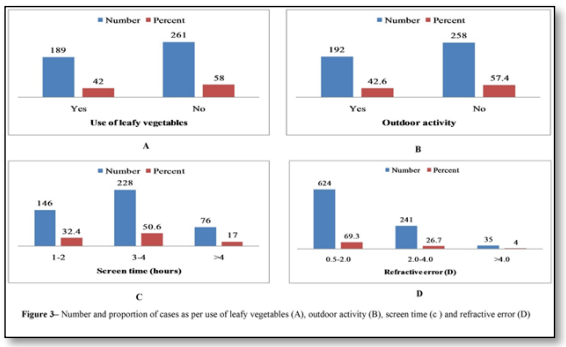

Figure 3– Number and proportion of cases as per use of leafy vegetables (A), outdoor activity (B), screen time (c) and refractive error (D)

Most of the casesdenied leafy vegetables as menu in diet and avoided outdoor activity significantly (p< 0.50). Maximum cases spend 3-4 hours in front of screen daily followed by 1-2 hours and >4 hours respectively (p<0.0001). Maximum eyes had refractive error range of 0.5-2.0D followed by 2.0-4.0D and>4 D (p<0.0001) (Figure 3).

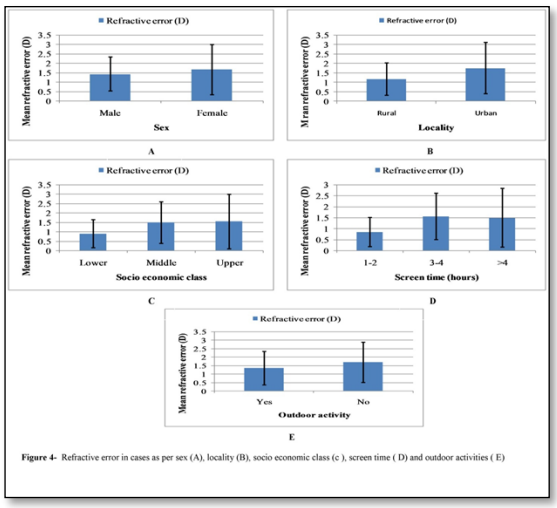

Figure 4- Refractive error in cases as per sex (A), locality (B), socio economic class (c), screen time (D) and outdoor activities (E)

We recorded significantly more refractive error in female cases than in male cases (p=0.001). Refractive error was more in cases belonging to urban locality than of rural locality (p<0.0001). Mean refractive error was maximum in cases of upper socioeconomic class and least in lower class(p<0.0001).It was maximum in cases with 3-4 hours screen time and least in cases with 1-2 hours screen time(p<0.0001). Refractive error was significantly less in patients with outdoor activities in comparison to those denied it (p<0.0001) (Figure 4).

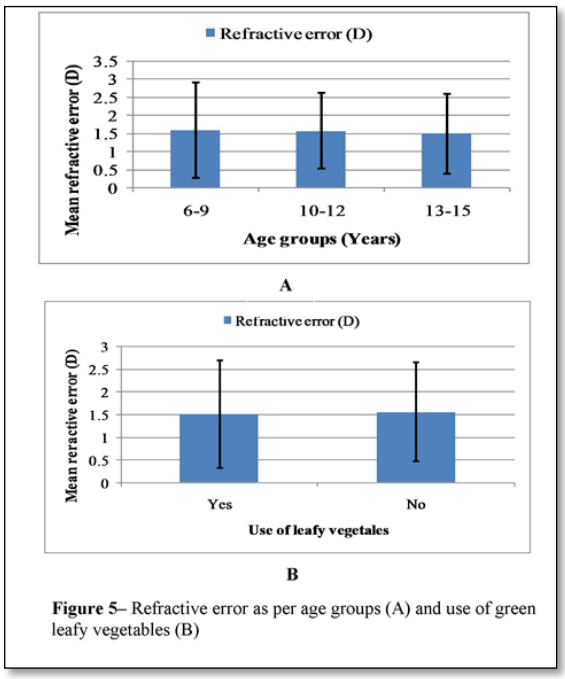

Figure 5– Refractive error as per age groups (A) and use of green leafy vegetables (B)

However, difference in refractive error was similar among cases under various age groups and whether they included leafy vegetables in diet or not (p>0.05) (Figure 5).

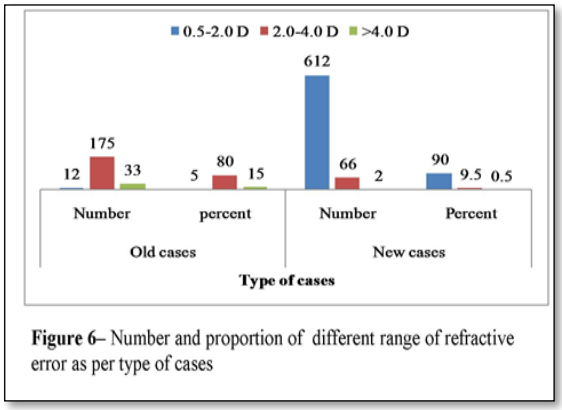

Figure 6– Number and proportion of different range of refractive error as per type of cases

So far extent of myopia was concerned, significant number of old cases fall under moderate and severe category while in new cases significant more cases was with mild myopia (Figure 6).

DISCUSSION

Most workers observed similarity in extent of myopia in male and female cases. Proportion of male and female cases was 53.7% and 46.3%respectively in Spanish children.[20] The prevalence of myopia in boys and girls was same (9.6%) or similar (13.7% & 13.5% respectively) during different assessment period.[21] In a study on the effect of increased screen hours during COVID 19 home confinement on the degree of progression of myopia, 41.42% were girls and 58.58% were boys.[22] There were 56.2% females and 43.2% males participants in an online survey to assess computer vision syndrome in children due to excessive screen exposure during the COVID 19 pandemic lockdown.[23] Hence we find similar

proportion of genders with myopic condition as observed in previous studies. In present study, we included school going children in age range of 6-15 years. Most of the studies are on cases in school going adolescent while few studies included cases with older age.[13,24,25]

We met significantly more cases belonged to urban locality than cases in rural locality. Out of 12241 School going children from both rural and urban included in the study, 69.7% lived in urban areas 24. Among the respondents, 76.4% were located in urban areas, 7% reside in urban-rural transitional areas, and 16.6% lived in rural areas.[26] The prevalence of myopia in school-going adolescents in urban areas with watching television for ≥3 hr/day (30.02%) was significantly more than in rural areas.[27] Thus most of the cases confronted in urban area in present study are similar to the previous studies. We met maximum and minimum cases of myopia belong to middle and upper socioeconomic group. Insignificant difference was recorded during different study periods in case of low (14.8% & 11.6%), middle (59.8% & 61.5%), and high (24.5%& 26.6%) socioeconomic groups. However it is clear that middle and high groups are more prone to myopia.[21]

We noted similar proportion of cases that used and did not used leafy vegetables as menu in diet. Very few studies have been found those mentioned connection of myopia with leafy vegetables. Workers indirectly considered green leafy vegetables as important for proper vision.[19,28] Proportion of vegetarian cases ranges between 12.5%-16.7% in a study conducted in rural India.[18]

We recorded significantly less cases with outdoor activity. Outdoor time was significantly lower in younger children, girls and Chinese children.[24] COVID-19 lockdown has largely affected the lifestyle of school-going children by significantly decreasing their outdoor activities and increased online exposure to screen.[23] Careful study of literatures showed that Workers has taken physical activity different from crude outdoor activity. Ignoring such differences we observed similarly less outdoor activities in general. In present study cases spend different time durations in front of screen. Mean daily reading and writing time were 2.26 ± 1.27 h/d, screen time including TV was 2.12 ± 1.35 h/d, and total near work was 4.46 ± 1.89 h/d with screen time percentage contribution of 45 ± 19% in total near work.[24] Concerning electronic device use during near vision activities, 34.7% of children spent>3 h / day, 25.9% spent between 2 -3 h / day and 39.4% spent <2 h / day performing said tasks.[20] TV/computer and internet duration was >2 hours among children and adolescents.[21] Compared to the pre-pandemic era, the screen exposure duration had increased to the range of less than 1 h in 46 (24.9%), 1–2 h in 60 (32.4%), 2–3 h in 24 (13%), and more than 4 h in 25 (13.5%) children.[23]

In present study maximum cases had less refractive error. Apart from this, mean refractive error in male cases was significantly lower than in female cases. Various workers measured myopic condition by different parameters viz. refractive error (RE), spherical equivalence (SE), spherical equivalent error (SER), uncorrected visual acuity (UCVA) and axial length (AL). The mean SE value was 0.80 ± 2.03 D (0.00 ± 0.15Din ametropic, 2.34 ± 1.67D in hypermetropy, and−1.64 ±1.54D in myopia). Mean SE values were 0.81 ±2.10 D in male and 0.78 ± 1.95 D in female participants.[20] Mild (0.5–3.0 SER), moderate (3.0–6.0 SER), and severe (>6 SER) myopia was recorded in 17.13, 27.01, and 11.33% students respectively.[25] Mean spherical equivalent was −1.69 ± 1.42, −1.92 ± 1.50, −2.61 ± 1.47 and−1.68 ± 1.51,− 1.87 ± 1.58, −2.73 ± 1.78 in year 2018, 2019 and 2020 respectively for the right and left eye respectively with significant myopic shift (Pre pandemic/ COVID 19 pandemic comparison). The mean uncorrected visual acuity (UCVA, Log MAR, 0.35 ± 0.42) in 2020 was higher than that in 2019.[22] Therefore we observed similar myopic optometric range.

We observed no significant difference in refractive error among patients under various age groups. The prevalence of myopia increased progressively with age.[20] A comparison of the change in spherical equivalent refraction between the different age groups was insignificant.[22] It was concluded that prevalence of myopia in children and adolescents in Germany has remained virtually unchanged over a period of approximately 10 years.[21] Significantly more individuals reported myopic symptoms from pre-primary, lower-secondary, and upper-secondary grades, while respondents enrolled in primary grades report significantly less. Therefore, individuals at different educational level and hence in various age groups had significant difference in myopic condition.[26] It is clear that some workers found association of myopic progression and cataract with age, while others did not.

In present study mean refractive error was significantly less in cases of rural locality than of urban locality. Very few studies mentioned difference in mean refractive error as per locality. The prevalence of myopia in school-going adolescents in urban areas with watching television for ≥3 hr/day (30.02%) was significantly more than in rural areas.[27] Thus most of the cases confronted in urban area in present study is similar to the previous studies.

In present study, upper class cases have maximum mean refractive error and least in lower class. Insignificant difference in prevalence of myopia was recorded in case of low (14.8% & 11.6%), middle (59.8% & 61.5%), and high (24.5%& 26.6%) socioeconomic groups.[21] Easy availability of electronic device, less physical work and thus life style may be the reason for higher mean refractive error in such socioeconomic members.

We observed progression in refractive error with increase in screen time. It was found that more time spent in near-vision activities and using electronic

devices, the more significant the trend toward my opization.[20] No significant association between myopia and ST was noted with increase in screen time.[25] Changes in media consumption, such as the increased use of smartphones had no detectable impact on the development of myopia.[21] It is clear that most workers observed no association between screen time and myopic progression.

We observed similar mean refractive error in cases whether they included leafy vegetables in diet or not. Increased probability of myopia with a higher intake of refined carbohydrates in girls and a lower intake of refined carbohydrates in boys was reported. Higher intake of protein, fibre, copper, magnesium, solid food weight, higher zinc concentration in hair, as well as lower serum concentration of vitamin D, zinc, selenium and lack of breastfeeding were associated with the presence of myopia. Higher intake of saturated fats and cholesterol was found to be associated with longer AL. It was concluded that most of the nutrients and dietary elements investigated in noni intervention studies showed inconsistencies in their association with myopia, with the majority indicating noassociation.[10] The prevalence of myopia in school-going adolescents was significant with less consumption of vitamin A rich foods (green leafy vegetables).[27] Leafy vegetable intake in general, lutein/zeaxanth in and dietary diversity was not related to cataract.[18] So, some workers found association of green leafy vegetables with myopia, others did not. It is also important to note that most of the workers did not mentioned/worked green vegetables directly but their nutritional ingredients. Green leafy vegetables are rich in folate, vitamin A and other phytochemicals and deficient in carbohydrates, fats and low energy content. Here we approximated the green leafy vegetables with these ingredients.

We observed significantly less mean refractive error in cases with outdoor activity. It was concluded that more time spend on outdoor activities less likely to develop myopia.[20] College students with high PA (physical activity) had 5.1% lower relative risk of developing myopia compared with those with low PA.[25] Engagement in physical activity was higher in the myopia group, with 41.3% being active, against 38.5% in the non-myopia group.[19] Lower prevalence ofmyopia was recorded among the children who played (27.8%) than who do not (41.8%) outdoor games.[28] Thus most previous workers found outdoor activity as a measure to improve/check myopic condition/progression. We observed similar association of outdoor activity with myopia.

In present study significant number of old cases fall under moderate and severe category and in new cases significant more cases were with mild myopia. Myopia is generally detected before age of 10 years, but it may onset in the age of 3 to 4 years to late teenage or early adulthood depending on ethnic, familial, environmental, and geographical factors. In general, extent of myopia progresses with time in early life. The annual progression rate was higher in the year before detection and in the year following when myopia was first detected, but declined thereafter.[29,30] In present study we observed that condition of old cases get more worsen than newly identified myopic cases. We did not measured rate of progression but clearly observed more increment of extent of myopia that is the agreement with these previous findings.

CONCLUSION

In conclusion both genders (male and female) have similar chance of getting myopia. Children of urban area are more prone to myopic condition. School going children in various age groups may have similar refractive errors and thus myopic condition. Myopia progresses as screen time to electronic devise increases. Outdoor activities improve eye condition while use of green leafy vegetables may/may not improve myopic condition. Extent of myopia increases as duration of symptom goes on.

REFERENCES

1. Agarwal D, Saxena R, Gupta V, Mani K, Dhiman R et al. Prevalence of myopia in Indian school children: Meta-analysis of last four decades. PLOS ONE.2020; 15(10): e0240750. https://doi.org/10.1371/journal.pone.0240750
2. Grzybowski A, Kanclerz P, Tsubota K, Lanca C, Saw SM. A review on the epidemiology of myopia in school children worldwide. BMC Ophthalmol. 2020; 20(1):27. doi: 10.1186/s12886-019-1220-0.
3. Wang YM, Lu SY, Zhang XJ, Chen LJ, Pang CP, Yam JC. Myopia genetics and heredity. Children (Basel). 2022; 9(3):382. doi: 10.3390/children9030382.
4. Biswas, S., El Kareh, A., Qureshi, M. et al. The influence of the environment and lifestyle on myopia. J PhysiolAnthropol. 2024; 43, 7 https://doi.org/10.1186/s40101-024-00354-7
5. Liang CL , Yen E , Su JY , Liu C , Chang TY , Park N, Wu MJ , Lee,S Flynn JT , Juo SH . Impact of family history of high myopia on level and onset of myopia. Investigative ophthalmology. 2004; 45(10):3446-52. doi: 10.1167/iovs.03-1058
6. K Zadnik,WASatariano, DO Mutti, RI Sholtz, AJ Adams. The effect of parental history of myopia on children's eye size. JAMA. 1994; 271(17):1323-7
7. Ramamurthy D, Lin Chua SY, Saw SM. A review of environmental risk factors for myopia during early life, childhood and adolescence.Clinical& experimental optometry.2015; 98(6):497-506. doi: 10.1111/cxo.12346.
8. YY Lee, CT Lo, SJ Sheu, TL Yin. Risk factors for and progression of myopia in young Taiwanese men. Ophthalmic epidemiology. 2015; 22(1):66-73. doi: 10.3109/09286586.2014.988874
9. FlitcroftDI,HarbEN,Wildsoet CF. The spatial frequency content of urban and indoor environments as a potential risk factor for myopia Development. Investigative ophthalmology & visual science. 2020; 61(11):42. doi: 10.1167/iovs.61.11.42
10. Chamarty S, Gupta SK, Dhakal R andPavan K. Verkicharla PK. Is there any association between nutrition and myopia? A systematic review.Optom. Vis. Sci. 2023; 100(3): 475-85. doi:10.1097/OPX.0000000000002035
11. Yin C, Gan Q, Xu P, Yang T, Xu J, Cao W, Wang H, Pan H, Ren Z, Xiao H, Wang H, XuY and Zhang Q. Dietary patterns and associations with myopia in Chinese children.Nutrients. 2023; 15(8): 1946.10.3390/nu15081946
12. Shetty A, Ganguly A , Chodankar S, Usgaonkar U. Dietary intake and its association with myopia in children in Goa. Indian Journal of Clinical and Experimental Ophthalmology. 2023; 9 (4): 606-610

13. 13. Kim JM, Koi YJ. Association between dietary nutrient intake and prevalence of myopia in Korean adolescents: evidence from the 7th Korea National Health and Nutrition Examination Survey. Front Pediatr. 2024; 11; 11:1285465. doi: 10.3389/fped.2023.1285465.
14. Fedor M, Urban B, Socha K, Soroczyńska J, Krętowska M, Borawska MH, Bakunowicz-Łazarczyk A. Concentration of zinc, copper, selenium, manganese, and Cu/Zn ratio in hair of children and adolescents with myopia. J Ophthalmol. 2019; 5643848. doi: 10.1155/2019/5643848.
15. Massoudi S, Azizi-Soleiman F, Yazdi M, MeghdadiEsfahani M, Heidari-Beni M, Kelishadi R. The association between macronutrients intake and myopia risk: a systematic review and meta-analysis. BMC Ophthalmol. 2024; 24(1):472. doi: 10.1186/s12886-024-03738-6.
16. Lim LS, Gazzard G, Low YL , Choo R, Tan DTH, Tong L, Wong TY, SeangSM. Dietary factors, myopia, and axial dimensions in children. Ophthalmology. 2010; 117 (5): 993-997
17. Wolf AT, Klawe J, Liu B, Ahmad S. Association between serum vitamin D levels and myopia in the national health and nutrition examination survey (2001-2006). Ophthalmic Epidemiol. 2024; 31(3):229-239. doi: 10.1080/09286586.2023.2232460
18. Bélanger J (2010). Green leafy vegetables of rural India: Ethnobotany and contribution to eye health. 2010; Ph.D. theses. McGill University, Montreal, Canada.
19. Kim JM and Choi YJ.Myopia and nutrient associations with age-related eye diseases in Korean adults: A cross-sectional KNHANES study. Nutrients. 2024 ; 16(9), 1276; https://doi.org/10.3390/nu16091276
20. Alvarez-Peregrina C, Sánchez-Tena MÁ, Martinez-Perez C, Villa-Collar C. The relationship between screen and outdoor time with rates of myopia in Spanish children. Front Public Health [Internet]. 2020;8. Available from: http://dx.doi.org/10.3389/fpubh.2020.560378
21. DeutscherÄ, rzteverlag GmbH. Prevalence and time trends in myopia among children and adolescents. Available from: https://www.aerzteblatt.de/int/archive/article/217031
22. Mohakud N, Dash S, Mohanty G, Mohanty S. Progression in refractive error in children during COVID-19 pandemic due to virtual classes: A cohort study. Curr Med Issu [Internet]. 2023;21(2):110. http://dx.doi.org/10.4103/cmi.cmi_108_22
23. Wadhwani M, Manika M, Jajoo M, Upadhyay A. Online survey to assess computer vision syndrome in children due to excessive screen exposure during the COVID 19 pandemic lockdown. J Family Med Prim Care [Internet]. 2022; 11(9):5387.
24. Lanca C, Yam JC, Jiang W-J, Tham Y-C, HassanEmamian M, Tan C-S, et al. Near work, screen time, outdoor time and myopia in schoolchildren in the Sunflower Myopia AEEC Consortium. ActaOphthalmol [Internet]. 2022;100(3):302–11. Available from: http://dx.doi.org/10.1111/aos.14942
25. Xie J, Lu C, Zhu J. Screen time and myopia: A serial multiple mediator SEM analysis. Front Public Health [Internet]. 2022;10. Available from: http://dx.doi.org/10.3389/fpubh.2022.860098
26. Liu J, Li B, Sun Y, Chen Q, Dang J. Adolescent vision health during the outbreak of COVID-19: Association between digital screen use and myopia progression. Front Pediatr [Internet]. 2021; 9. https://pubmed.ncbi.nlm.nih.gov/34113588/
27. Keerthana V, Allam, Reddy S, Dulipala and Phanindra . Myopia prevalence and risk factors among school-going adolescents. Journal of Dr. YSR University of Health Sciences. 2023; 12(3): 272-276, DOI: 10.4103/jdrysruhs.jdrysruhs_169_22
28. Krishnamurthy H, Jose T, Shivanna S,Naik GT, Shivamurthy A. A Study on socioeconomic, nutritional, andindividual factors on prevalence of Myopia in school-age children.Int J Sci Stud. 2022; 10(2):95-101.
29. MuttiDO, Zadnik K,Fusaro RE, Friedman NE, RI Sholtz, AdamsAJ. Optical and structural development of the crystalline lens in childhood. Investigative ophthalmology & visual science. 1998; 39: 120-133.
30. Xiang F, MingguangHe, Morgan IG. Annual changes in refractive errors and ocular components before and after the onset of myopia in Chinese children. Ophthalmology. 2012; 119 (07): 1478-84.