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RESEARCH ARTICLE

Refractive error and associated risk factors in 6-12 years schoolchildren

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ABSTRACT

Background: Refractive error (RE) is one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness. Lack of awareness about risk factors and complications that arise, are the reasons for an increasing trend an early age. **Aims and Objectives:** This study aimed at finding the influence of risk factors on RE among rural and urban schoolchildren and its prevalence. **Materials and Methods:** A total of 1300 schoolchildren in the age group of 6-12 years were screened for REs. Children with visual acuity <6/9 were referred for objective refraction. The various risk factors involved were assessed using a pretested questionnaire. **Results:** The proportion of children with RE was significantly more in urban (17.5%) than in the rural area (12%). Myopia (14.6%) was the common RE in rural and urban children. Of the risk factors studied, duration of watching television (TV), distance from which TV was watched, duration of computer/video/mobile games, and the duration of play outside had a statistically significant association to the prevalence of RE. **Conclusion:** This study proves that the risk factors associated with RE that can be avoided and helps in creating awareness to children, parents, and particularly, the teachers who play an important role in shaping the child's career and behavior. The necessity of proper and constant wear of spectacles should be emphasized.

KEY WORDS: Refractive Error; Risk Factors; Schoolchildren; Prevalence

INTRODUCTION

Refractive error (RE) is one of the most common causes of visual impairment around the world and the second leading cause of treatable blindness.[1] It has been estimated that 2.3 billion people worldwide have RE, but only 1.8 billion people have access to eye examinations and affordable correction.[2] The World Health Organization (WHO) has launched a campaign for managing REs by the year 2020 and places it in the fifth position for its urgency.[3,4] In the global initiative 2020 for the elimination of avoidable blindness, REs have been emphasized together with other ocular disorders such as cataracts, trachoma, and onchocerciasis.[5] Various studies from South India[6-8] document the prevalence of REs that range from 5% to 25%. School-age children constitute a particularly vulnerable group because uncorrected RE may have a dramatic impact on learning capability and educational potential.[9] Some teachers, who do not realize the underlying problem of the children, brand them lazy. Children with RE who are noticed by the parent or the teacher and brought to an ophthalmologist are relatively few. Although vision screenings are not diagnostic, their results may indicate a potential need for further assessment. The availability of optical correction with spectacles is relatively of little cost. The proportion of children who are visually impaired due to REs can be used to assess the level of development of

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eye care services in a country. Therefore, we believe that the magnitude of the problem of REs needs a systematic assessment of vision and correction by the application of appropriate glasses at an early age. Although the national programs are aimed at controlling blindness, the number of children developing RE keeps on increasing day by day. This may be due to lack of awareness about risk factors and complications that arise due to RE. Moreover, not many studies have been documented regarding the prevalence of RE in rural and urban schoolchildren (6-12 years) in Puducherry. Hence, we aimed at finding the prevalence of RE in rural and urban schoolchildren in Puducherry and to assess and compare the influence of risk factors on RE among rural and urban schoolchildren.

MATERIALS AND METHODS

This cross-sectional study was conducted among schoolchildren in the age group of 6-12 years after obtaining permission from the Institute Ethical Committee, elementary educational officer, and school authorities. Using the formula $4PQ/L^2$ and the prevalence of 25% from previous studies, the sample size was calculated as 1200. Cluster sampling method was adopted. The list of schools in Puducherry was collected from which two schools from urban and two from rural area were randomly selected. The selected school was considered as a cluster and all the students in the age group of 6-12 years were screened for REs to attain the sample size of about 1300 anticipating dropouts. Each participating school was visited 2 weeks before the screening day to make arrangements for the examination room with adequate lighting. A consent form, personal information sheet, and a pretested questionnaire were given to each of the participants to be taken to their parents. Only children, who returned duly signed consent forms and who were willing to take part, were recruited for the study. Children, who had eye surgery, squint, fever, and previous H/O injuries in the eye, were excluded in the study.

The personal information sheet explained the purpose of the intended study, what would actually be done and also the details regarding the demographic data such as name, age, parents' education, occupation, number of family members, and family income per month.

The questionnaire included the various risk factors such as type of house, lighting condition, duration and distance of the child watching computer/television (TV), duration of near work, details about the previous history of spectacle wear, and history of REs in parents.

The examination of the eye of each child was carried out using the Snellen's chart at a conventional distance of 6 m. A visual acuity <6/9 in either eye or both eyes[10] was taken as a cutoff level for visual impairment and, these children were evaluated employing subjective refraction with the help of auto refractometer. These students were referred to the Ophthalmic Department, Indira Gandhi Medical College or nearest PHC for objective refraction with streak retinoscopy after 1% cyclopentolate drop instillation in each eye twice with 15 min interval for at least ½ h prior examination.

Follow-up was done after 1 week and again after 15 days in the school to ensure that the referred children had undergone complete ophthalmic examination and were wearing the spectacles regularly. All data were entered into MS Excel sheet, and analysis was done using SPSS software version 17. The prevalence of children with REs in both the groups was calculated. The influence of family history of refractive status on RE of the children was done using Chi-square test. Comparison of means of risk factor (duration and distance) variables was done using unpaired *t*-test.

RESULTS

A total of 1300 children were enrolled for the study, of which 56 children did not attend school on the day of screening for various reasons not related to the study, 23 children did not return the filled forms, and of the filled forms, 18 were not answered properly. A total of 1203 were screened for RE, 603 from a school in urban area and 600 from a school in rural area.

The proportion of children with RE was significantly more in urban (17.5%) than in the rural area (12%) as shown in Table 1. There was no significant difference in relation to gender and RE with 14.5% boys and 14.8% girls having RE. Of the 105 children, with RE in the urban area, 8.66% had myopia, 1% had hypermetropia, 3.5% had simple myopic astigmatism, 0.06% had simple hypermetropic astigmatism, 3.03% had compound myopic astigmatism, and 0.33% had compound hypermetropic astigmatism. In the rural area of the 72 children with RE, 6% had myopia, 0.5% had hypermetropia, 2% had simple myopic astigmatism, 0.5% had simple hypermetropic astigmatism, 2.1% had compound myopic astigmatism, and 0.2% had compound hypermetropic astigmatism.

Table 2 shows the refractive status of the child whose parents had RE, which shows a significant association.

Socioeconomic status did not have an influence on RE in both urban and rural area.

Of the risk factors studied, duration of watching TV, distance from which TV was watched, duration of computer/video/mobile games, and the duration of play outside had a statistically significant association to the prevalence of RE as shown in Table 3. Comparing the risk factors between the urban and rural schoolchildren, duration of near work was

significantly higher for the children in urban area as depicted in Figure 1.

72% in Urban and 81% parents in rural area did not emphasize on constant wear of spectacles and 23% and 19% parents of children in urban and rural area, respectively, considered that constant wear would lead to altered appearance of their ward.

DISCUSSION

The WHO, in 2002, has estimated that globally 153 million people are visually impaired because of uncorrected REs.[11] REs are common in children and are the most common cause of visual impairment around the world and the second leading cause of treatable blindness.[12,13]

Schoolchildren, 5-15 years of age, screened for eye morbidity and revealed RE as 7.4% in rural Delhi.[14] A study to assess the prevalence of RE and common ocular diseases in urban school-aged children in Hyderabad shows that the prevalence of uncorrected RE was 9.8%[15] and hyperopia as 3.4%. Prema[8] observed in a school at Chennai that of 123 only 77 (62.61%) students were with good vision and the remaining 46 (37.39%) were affected by RE.[8] Our results show the prevalence of RE was 39.5%, of which, 17.5% was in urban area and 12% in rural area in Puducherry. The prevalence was less in other studies from South India compared to our study. Visual acuity of <6/9[10] was used in our study, whereas <6/12 was used for screening in other studies which could have been the reason for higher prevalence in our study.

Significant gender difference with more girls having myopia was reported in the study from Davangere[16] while no difference was observed by Wong et al.[17] There was no predisposition of RE between genders as evident from our results.

Das et al.[7] observed that among the schoolchildren aged 5-10 years in Kolkata, 25.11% had REs, myopia being the most common (14.02%) followed by astigmatism 3.93%. Myopia was more prevalent compared to other types of RE in our study. Myopia can be inherited maybe through genetic determination of the axial length of the eye. Few studies have noted[1] that children with high myopia are more likely to have parents with myopic vision. Myopia was more common in children of fathers with higher levels of education. In contrary, Mutti et al.[18] observed interactions between parental myopia and near work that were not significant ($P = 0.67$) indicating no increase in the risk associated with near work with an increasing number of parents with myopia.

Our results show that RE in children was higher when both parents had RE. This finding suggests that genetic factors play a significant role. Uzma et al.[14] have observed that children with high myopia spent more time studying, reading, and less time playing sports. Yingyong et al.[19] suggested that perhaps parents with myopia have children with myopia only because they pass along a myopigenic environment with intense near work demands. It is evident from our study that children who watched TV from a distance <3.5 ft and played computer/

Table 1: Comparison of prevalence of RE of children in urban and rural area

Area	Gender	*N* (%)		
		Normal	With RE	Total
Urban*	Male	247 (83.44)	49 (16.56)	296 (100.00)
	Female	251 (84.80)	56 (15.20)	307 (100.00)
Rural	Male	265 (87.74)	37 (12.26)	302 (100.00)
	Female	263 (88.25)	35 (11.75)	298 (100.00)

*$P \leq 0.05$ significance. RE: Refractive error

Table 2: Proportion of children with and without RE based on family history of RE

Area	Family history of RE	Refractive status of child *N* (%)	
		Refractive error present	Normal
Rural	One parent (*n*=92)	14 (15.3)	78 (84.7)
	Two parent* (*n*=9)	6 (55.5)	3 (44.4)
	None (*n*=499)	52 (10.4)	447 (89.6)
Urban	One parent (*n*=144)	33 (23)	111 (77.1)
	Two parent* (*n*=24)	14 (58.3)	10 (41.7)
	None (*n*=435)	58 (13.4)	377 (86.6)

*$P<0.05$ significance. RE: Refractive error

Table 3: Association of risk factors and prevalence of RE in urban and rural area

Risk factors	Mean±SD			
	RE absent (urban)	RE present (urban)	RE absent (rural)	RE present (rural)
Play outside (h)	1.8±1.3	1.08±0.71*	2.07±1.12	1.49±0.9*
Duration of watching TV (h)	1.97±1.2	2.4±1.3*	1.18±1.6	1.89±1.2*
Duration of watching computer games (h)	0.44±0.5	1.03±0.8*	0.16±0.2	0.39±0.24
Distance from which TV is watched (ft)	4.9±1.2	3.68±1.9*	5.5±1.7	4.3±2
Duration of sleep (h)	7.64±1.1	7.3±0.9*	8.7±1	8.5±0.9
Study hours	1.98±1.6	2.1±2.0	1.87±1.3	1.93±1.02

*$P<0.05$ significance. TV: Television, SD: Standard deviation, RE: Refractive error

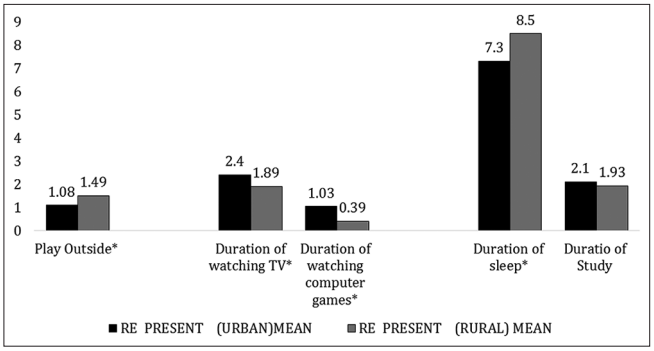

Figure 1: Comparison of risk factors among rural and urban schoolchildren

video/mobile games for a longer duration had RE than their normal counterparts which suggest that more hours of near work was associated with RE. Similarly, children were less likely to have RE when they spent more time on outdoor games. Comparing the urban and rural children near work was more and duration of outdoor games was less with the urban children. Congestion of space due to urbanization forcing them to play such games is an ironical fact that has to be accepted. The influence of socioeconomic status on RE was not statistically significant in contrary to that observed by Wong et al.[17] This finding indicates that the risk factors play an important role in the development of RE compared to the standard of living.

We also observed that 72% parents in urban and 81% parents in rural area did not emphasize on constant wear of spectacles. Surprisingly, among the various reasons stated by the parents for not advising constant wear was altered appearance of the child which the parents opined would distance them from other children psychologically. Even in the urban area, 23% of parents had this idea. Therefore, this study will help in creating awareness about the risk factors of RE among children, teachers, and parents. It also supports the assumption that vision screening of schoolchildren in developing countries could be useful in detecting correctable causes of decreased vision, especially REs and in minimizing long-term visual disability. A major lacuna in the study was the ability to reach out to children not attending schools. However, this may be addressed by increasing the frequency of school screening.

Long-term studies have to be carried out to ensure the proper wear and maintenance of spectacles.

RE is the second leading cause of visual impairment. The parents, children, and particularly, the teachers who play an important role in shaping the child's career and behavior should be aware of the possible risk factors and the necessity of proper and constant wear of spectacles. The awareness among people will help us to attain the goal of Vision 2020 (right to sight) at the earliest.

CONCLUSION

This study proves that the risk factors associated with RE that can be avoided and helps in creating awareness to children, parents, and particularly, the teachers who play an important role in shaping the child's career and behavior. The necessity of proper and constant wear of spectacles should be emphasized.

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