Research Article

# Prevalence of refractive error among school-going children of Imphal, Manipur

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**Abstract**

**Background:** Uncorrected refractive error is the leading cause of eye problem and the second cause of blindness worldwide. Among children aged 5–15 years, 12.8 million are visually impaired because of refractive errors.

**Objective:** To assess the magnitude of refractive error among school-going children of Imphal, Manipur, India, and to determine the association between refractive error and variables such as sex, dietary habits, family history, and daily activities such as watching television and using computers.

**Materials and Methods:** This was a cross-sectional study conducted among upper primary school students (students of classes six and seven) of Imphal from June 21, 2014 to July 8, 2014. Sample size was calculated to be 267. Cluster sampling method was used to select the study participants. Snellen chart, Roman test type chart, and pinhole were used to detect refractive error. Analysis was done using $\chi^2$-test and Fisher's exact test. *P* value of <0.05 was taken as significant.

**Result:** Total number of respondents was 302. Prevalence of refractive error was 29.14% and among them only 20.5% were already wearing glasses for correction. Prevalence of refractive error was significantly associated with watching television sitting nearby, using computers, positive family history, problem while reading the blackboard in the class, and problem while watching TV, computer, or playing video games.

**Conclusion:** Students, parents, and teachers must be educated about the early detection of refractive error and correction with spectacles to prevent progression of visual impairment.

**KEY WORDS:** Refractive error, prevalence, uncorrected, school students

## Introduction

Refractive error is an optical defect intrinsic to the eye, which prevents the light from being brought to a single focus on the retina; thus, reducing normal vision.[1] Uncorrected refractive error is the leading cause of eye problem worldwide and the second cause of blindness.[2] It is estimated that about 2.3 billion people worldwide have refractive errors; of which 1.8 billion have access to adequate eye examination and affordable corrections leaving behind 500 million people, mostly in developing countries, with uncorrected error causing either blindness or impaired vision.[3] Among children aged 5–15 years, 12.8 million are visually impaired because of refractive errors representing a prevalence of 0.97% with higher prevalence reported in China and urban areas of Southeast Asia.[4] Refractive errors are usually present in the childhood and continue to the adult life.[5,6] Undetected and uncorrected refractive errors are particularly a significant problem in school children.[3] As children are not mature enough to point out the deficiency at an early stage or the parents have no idea on the gradually developing vision problem, uncorrected refractive error can have a dramatic impact on learning process and educational capacity.[7] Most of the children with such diseases are apparent and hence, screening helps in early detection and correction with spectacles.[8] In the global initiative,

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Vision 2020, for the elimination of avoidable blindness, refractive error has been emphasized.[9] As the treatment of refractive errors is perhaps the simplest and effective forms of eye care, blindness because of refractive error can be prevented. This study was conducted to assess the magnitude of refractive error among school-going children of Imphal, Manipur, India, and to determine the association between refractive error and variables such as sex, dietary habits, family history, and daily activities such as watching television and using computers.

## Materials and Methods

This was a cross-sectional study conducted among upper primary school students (students of classes six and seven) of Imphal, the capital city of Manipur from June 21, 2014 to July 8, 2014. Taking prevalence as 50%, with an absolute precision of 7.5% at 5% significance level, sample size was calculated to be 177. With a design effect of 1.5, the final sample size was estimated to be 267. Hence, approximately 300 students were targeted for data collection. Six schools were randomly selected with probability proportionate to size, and students in each school were selected by simple random sampling. The number of students selected from each school was proportionate to the strength of the school. Those who were absent on the day of data collection were excluded from the study. The study tools used were a structured interview schedule, Snellen chart, Roman test type chart, measuring tape, eye shield, torch light, and pinhole.

Data were collected by interns posted in Community Medicine Department of Regional Institute of Medical Sciences (RIMS), Imphal, who were trained to conduct interviews and ophthalmic examination. In a well-lighted room, Snellen chart was fixed on a wall at eye level. After interviewing the respondents, visual acuity was tested for far vision with Snellen chart at a distance of 6 m for each student, one at a time. Near vision was tested with Roman test type chart kept at a distance of 30 cm from the eyes of the subjects. One eye was tested first with the other eye covered with an eye shield. After 2 min, the other eye was tested similarly. Any other eye problems were also checked. Students having visual acuity ≤6/9 for far vision and <N5 for near vision were tested with the pinhole. Students who had improvement in the visual acuity after pinhole testing were considered to be having refractive error. Students found to have refractive error and other eye problems were referred to Ophthalmology Outpatient Department, RIMS. Ethical approval was obtained from institutional ethics committee, RIMS before the initiation of the study. Informed consent was obtained from school principals and verbal assent or consent was taken from students. Steps were taken up to maintain confidentiality.

The following operational definitions were used:

- Myopia: Visual acuity ≤6/9 in any eye for far vision, if improved after pinhole testing, was taken as myopia
- Hypermetropia: Visual acuity <N5 in any eye for near vision, if improved after pinhole testing, was taken as hypermetropia

Data collected were checked for completeness and consistency, and those were entered in IBM SPSS version 20 software. Descriptive statistics such as mean and percentages were used. Analysis was done using $\chi^2$-test and Fisher's exact test. *P* value of < 0.05 was taken as significant.

## Result

Total number of respondents was 302. Mean age of the respondents was 12.4 ± 1.03 years with a range of 10 to 17 years. Table 1 shows that about two-thirds of the respondents were boys and majority of them were Hindus.

Prevalence of refractive error was 29.14%. Myopia was the most common type of refractive error constituting 27.15% of the participants whereas 1.3% had both myopia and hypermetropia [Figure 1].

Figure 2 shows that of those who were having refractive error, only 20.5% of them were already wearing glasses for correction.

Table 2 shows that about 16.9% of the respondents had an eye checkup in the past.

Prevalence of refractive error was greater among those who had problem when reading the blackboard in the class and when viewing the television, using computer, or playing video games, and was found to be statistically significant. Prevalence of refractive error was significantly higher among those who watch television sitting nearby and those who use computers. Refractory error was significantly associated with family history of wearing glasses because of refractory error either among parents or siblings [Table 3].

**Table 1:** Sociodemographic characteristics of the respondents

| Sociodemographic characteristics | Number | % |
|---|---|---|
| Type of school | | |
| Government | 140 | 46.4 |
| Private | 162 | 53.6 |
| Gender | | |
| Male | 200 | 66.2 |
| Female | 102 | 33.8 |
| Religion | | |
| Hindu | 280 | 93.0 |
| Christian | 12 | 4.0 |
| Others | 9 | 3.0 |
| Class | | |
| Class VI | 167 | 55.3 |
| Class VII | 135 | 44.7 |

**Table 2:** History of having an eye checkup in the past

| Did you have any eye checkup | Refractive error present *n* (%) | Refractive error absent *n* (%) | Total *n* (%) |
|---|---|---|---|
| Yes | 27 (45.5) | 34 (25.2) | 51 (16.9) |
| No | 61 (54.5) | 180 (74.8) | 251 (83.1) |

**Table 3:** Association of refractive error with selected variables

| Characteristics | Refractive error present *n* (%) | Refractive error absent *n* (%) | Total *n* (%) | *P*-value |
|---|---|---|---|---|
| Type of school | | | | |
| Government | 34 (24.3) | 106 (75.7) | 140 (46.4) | 0.08 |
| Private | 54 (33.3) | 108 (66.7) | 162 (53.6) | |
| Sex | | | | |
| Male | 25 (24.5) | 77 (75.5) | 102 (66.2) | 0.21 |
| Female | 63 (14.0) | 137 (68.5) | 200 (33.8) | |
| Number of study hours per day | | | | |
| <4 | 35 (14.4) | 208 (85.6) | 243 (80.4) | 0.44 |
| >4 | 6 (10.1) | 53 (89.9) | 59 (19.6) | |
| Anyproblem while reading a book | | | | |
| Yes | 28 (42.4) | 38 (57.6) | 66 (21.9) | 0.28 |
| No | 60 (25.4) | 176 (74.6) | 236 (78.1) | |
| Any problem while reading the blackboard in class | | | | |
| Yes | 51 (54.3) | 43 (45.4) | 94 (31.1) | 0.00 |
| No | 43 (17.8) | 171 (82.2) | 208 (68.9) | |
| Watching television | | | | |
| Yes | 82 (29.4) | 197 (70.6) | 279 (92.4) | 0.74 |
| No | 6 (26.1) | 17 (73.9) | 23 (7.8) | |
| Duration of watching TV in a day | | | | |
| Upto 2 hours | 61 (27.2) | 163 (86.8) | 224 (74.2) | 0.11 |
| >2 hours | 21 (38.2) | 34 (61.8) | 55 (25.8) | |
| Distance of watching TV | | | | |
| Near (≤1 metre) | 40 (38.1) | 65 (61.9) | 105 (37.6) | 0.01 |
| Far (>1 metre) | 42 (24.1) | 132 (75.9) | 174 (62.4) | |
| Using computer | | | | |
| Yes | 34 (41.0) | 49 (59.0) | 83 (27.5) | 0.02 |
| No | 54 (24.8) | 165 (75.2) | 219 (72.5) | |
| Duration of using computer | | | | |
| Upto 2 hours | 27 (36.0) | 47 (64.0) | 74 (89.2) | 0.03 |
| >2 hours | 7 (77.8) | 2 (22.2) | 9 (10.8) | |
| Playing video games | | | | |
| Yes | 18 (32.1) | 38 (67.9) | 56 (18.9) | 0.55 |
| No | 69 (28.2) | 176 (71.8) | 245 (81.1) | |
| Duration of playing video games | | | | |
| Upto 2 hours | 18 (34.6) | 34 (65.4) | 52 (92.9) | 0.45* |
| >2 hours | 2 (50.0) | 2 (50.0) | 4 (7.1) | |
| Problem when watching TV, computer, or playing video games | | | | |
| Yes | 41 (36.3) | 72 (63.8) | 113 (37.4) | 0.03 |
| No | 47 (24.9) | 142 (75.1) | 189 (62.6) | |
| Daily intake of green leafy vegetables | | | | |
| Yes | 13 (41.9) | 18 (58.1) | 31 (10.2) | 0.10 |
| No | 75 (27.7) | 196 (72.3) | 271 (89.8) | |
| Daily intake of fruits | | | | |
| Yes | 7 (15.5) | 8 (53.3) | 15 (5.0) | 0.13 |
| No | 81 (28.1) | 206 (71.8) | 287 (95.0) | |
| Family history of refractive error | | | | |
| Present | 78 (42.2) | 107 (57.8) | 185 (61.2) | 0.00 |
| Absent | 30 (25.6) | 87 (74.4) | 117 (38.8) | |

*Analysis done by Fisher's exact test.

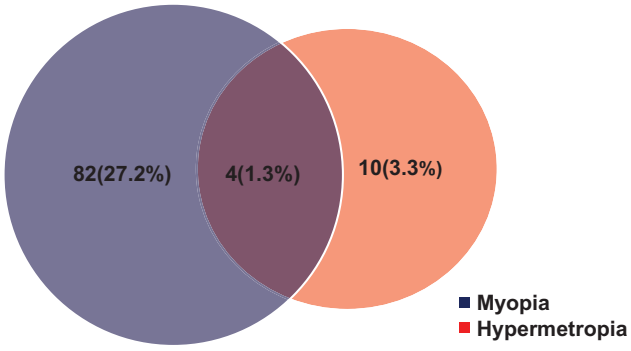


**Figure 1:** Prevalence of refractory error (88/302 = 29.1%).

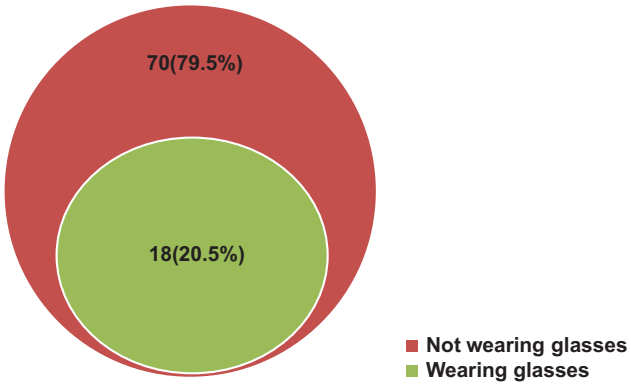


**Figure 2:** Wearing glasses for correction among students with refractive error.

## Discussion

This study shows that the prevalence of refractive error was 29.3%, which was more than most of the studies conducted around the world.[10–16] Studies conducted in China,[17] Japan,[18] Hong Kong,[19] Taiwan,[20] and Srinagar[21] showed higher prevalence whereas one study in Kancheepuram[22] showed prevalence similar to our study. These variations in prevalence could have been due to differences in demographic factors and different operational definitions for refractive error. The possibility of differences in ethnic background and differences in environment and socioeconomic conditions causing varying prevalence rates should also be considered. Among the refractive errors, myopia was common, which is similar to the findings seen in other studies.[10–13,15,18,21] This finding is contrast to that seen in some studies where prevalence of hypermetropia was higher.[14,17] Prevalence of uncorrected refractive error was higher as seen in some other studies in India.[11,17,22] But in studies conducted outside India such as China[12] and Egypt,[18] a higher proportion (95% and 43%, respectively) of children with refractive error were already wearing glasses. This higher prevalence of refractive error may be due to poor utilization of eye care services, which can be seen from the finding that only 16.9% of the participants had an eye checkup in the past. Ogbomo GOO et al.[14] reported a similar finding in Ghana where only 13.3% of the respondents had an eye checkup in the past.

There was no difference in the prevalence of refractive error between boys and girls but in some studies[10,12,13,15] girls showed higher prevalence. Rahman et al.,[11] Niroula and Sahal,[16] and Sun et al.,[18] reported higher prevalence among boys. Prevalence of refractive error was significantly higher among those who had problem in reading blackboard in the class. El-Bayoumy et al.[12] reported a similar finding where the prevalence of refractive error was higher among those who had problem in seeing distant objects. Presence of refractive error was significantly associated with a positive family history as seen in other studies.[10,15,18] Prevalence of refractive error was significantly high among those watching television sitting nearby and those who use computers. A similar finding was reported in some studies[13,15,21,23,24] where refractive error was significantly associated with close work or near activity such as prolonged study hours, watching computers/television, and so on. Prevalence of refractive error was high among those who do not eat fruits and vegetables daily but it is not statistically significant. The most worrying finding is that very few students consume fruits and vegetables daily because there are evidences to suggest that daily intake of fruits and vegetables can prevent refractive error.[25,26]

The strength of this study was that sample size was adequate. The limitation of this study was that as refractory error was diagnosed by pinhole testing and not by retinoscopy or subjective refraction; the prevalence of astigmatism could not be estimated and is misclassified as either myopia or hypermetropia. As this was a school-based study non-school-going children were left out from the sampling frame.

## Conclusion

We can conclude that refractive error was a significant cause of visual impairment among school children. Students must be educated to avoid unhealthy practices, such as watching television sitting nearby and indiscriminate use of computers and video games, to prevent the development of refractive error. Prevalence of uncorrected refractive error was also very high. Students, parents, and teachers must be educated about the early detection of refractive error and correction with spectacles to prevent progression of visual impairment. The existing school health services should be strengthened and implemented effectively for regular screening and to provide affordable corrective services.

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