A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI DISTRICT, TAMILNADU- 2015

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CERTIFICATE OF THE GUIDE

This is to certify that the dissertation titled **"A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI DISTRICT, TAMILNADU-2015"** is a bonafide work carried out by **Dr. MEGALA.M**, Post Graduate student in the Institute of Community Medicine, Madras Medical College, Chennai-3, under my supervision and guidance towards partial fulfillment of the requirements for the degree of M.D. Branch XV Community Medicine and is being submitted to The Tamil Nadu Dr.M.G.R. Medical University, Chennai.

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This is to certify that the dissertation titled **"A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI DISTRICT, TAMILNADU-2015"** is a bonafide work carried out by **Dr. Megala.M**, Post Graduate student in the Institute of Community Medicine, Madras Medical College, Chennai-3, under the guidance of **Dr. Joy Patricia Pushparani, M.D.,** towards partial fulfillment of the requirements for the degree of M.D. Branch XV Community Medicine and is being submitted to The Tamil Nadu Dr.M.G.R. Medical University, Chennai.

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DECLARATION

I, solemnly declare that the dissertation titled **"A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI DISTRICT, TAMILNADU-2015"**, was done by me under the guidance and supervision of **Dr. Joy Patricia Pushparani, M.D.,** Professor , Institute of Community Medicine, Madras Medical College, Chennai-3. The dissertation is submitted to The Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfillment of the requirement for the award of M.D. degree (Branch XV) in Community Medicine.

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ABBREVIATIONS

AL	Axial Length
AL-CR ratio	Axial Length-to Corneal Curvature Radius
BMI	Body Mass Index
COMET	Correction of Myopia Evaluation Trial
D	Dioptre
df	degree of freedom
IAPB	International Agency For The Prevention of Blindness
MSHP	Modified School Health Programme
NPCB	National Programme for Control of Blindness
NS	Not Significant
RE	Refractive Error
RESC	Refractive Error Study in Children Protocol
S	Significant
SCORM	Singapore Cohort Study of Risk Factors For Myopia
SE	Spherical Equivalent
SES	Socio Economic Status
SMS	Sydney Myopia Study
SVLs	Single Vision Lenses
TV	Television

URE	Uncorrected Refractive Error
VI	Visual Impairment
WHO	World Health Organization

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A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI DISTRICT, TAMILNADU- 2015

ABSTRACT

Background: Refractive Error is an avoidable cause of visual impairment. Children do not complain of defective vision. This warrants early detection and treatment of these problems to prevent future blindness.

Objectives: The study was conducted with the primary objective of estimating the prevalence of refractive error in school children and its associated factors among them. The secondary objective was to assess the extent to which children with refractive error are wearing corrective spectacles.

Materials and methods: This was a cross sectional study conducted in randomly selected four schools of Krishnagiri district in Tamilnadu. A semi structured questionnaire was used to collect the details of associated factors. The students were screened for refractive errors. Snellen's chart placed at 6 meters was used to test distant vision. Details of near work and outdoor activities were collected from their parents. Data was analysed using SPSS.

Results: Among the 422 students screened, 86 (20.4%) had refractive error. Only 18.6% (N=16) of those with refractive error were already diagnosed and using corrective spectacles for refractive error. The prevalence of refractive error showed significant association in univariate analysis with age, education and occupation of parents, socio

economic status, parental history of refractive error, duration of watching television and BMI.

Conclusion: Refractive errors among school children can be easily identified by regular eye screening programmes, promptly treated can be protected from future complications. Periodic screening of school children is very essential to improve the quality of eye-sight.

1. INTRODUCTION

"Eyes are the most precious of our sense organs. They contribute greatly to one's learning capacities right from childhood. Good vision contributes greatly to the strength of health and wits. The ultimate moulding of a person's personality and potentiality rests with his nature, surroundings and quality of eye sight."

Many ocular diseases have their origin in childhood and the morbidity may go unnoticed and adversely affect the child's performance in school and may also cause severe ocular disability in the later part of life. In school children, vision screening should be done very effectively to detect refractive errors, the correctable cause of decreased vision. It also helps in minimizing the long-term visual disability. In developing countries, children in the school-going age group represent 25% of the population. [1]Every sixth child in the world lives in India according to the statistics by Ministry of Statistics and Programme Implementation- 2012.

In refractive error, optical system of the eye fails to adjust to bring parallel rays of light to focus on fovea. Uncorrected refractive error leads to reduced vision; thereby it becomes a major public health problem in school children in India. Cataract is the major cause of blindness in India followed by refractive error. Refractive error is the commonest condition, seeking attention at ophthalmology outpatient department[2][3]·Poor vision impairs the performance of a child in school or at workplace and has a negative impact on the future of a child.

1

1.1 Magnitude of refractive error

Global data shows uncorrected refractive errors(43%) are the leading cause of visual impairment followed by un-operated cataract(33%)and glaucoma (2%).[4]

According to WHO release in 2014, 14 million are irreversibly blind all their lives and need visual rehabilitation interventions for their full psychological and personal development in children. These children are below 15 years of age among an estimated 19 million children who are visually impaired. Among them, 12 million children suffer due to refractive errors, a condition that could be rectified after an apt diagnosis.*"Vision 2020: the right to sight"* program, a global initiative launched by WHO in the year 1999 to prevent rectifiable blindness from worldwide by the Year 2020.By doing this, WHO prioritised prevention of blindness in children as an important agenda.

Developing countries accounts to three-fourth of total 1.4 million blind children across globe[5]. Global estimate states that 153 million people over 5 years of age are visually impaired primarily due to uncorrected refractive errors and 8million amongst are blind[6]. In the age group 5–15 years, 12.8 million are visually impaired from uncorrected or inadequately corrected refractive errors, a global prevalence of 0.96%. Highest prevalence reported in urban and highly developed urban areas in southeast Asia and in China[6]. An estimated 270,000 are reported to be blind children in India. The prevalence of blindness in school children is estimated to be 0.8/1000 children in the age group of 0-15 years[7].

Current epidemiological data point to an increased prevalence of refractive error in children[8]. Number of environmental factors associated to socioeconomic status and lifestyles have been reported, and are widely believed to be possibly responsible for these changes. Complicated interaction between genetic predisposition and environmental exposures are also seen as an important evidence for refractive errors.

Extended duration of near work activity, inappropriate and delay in refractive correction, incorrect reading posture or habits, inadequate rest to eye functions, lack of outdoor activities, excessive television watching and increased duration of computer activity were the possible determinants of myopia[9]. Previous studies on refractive error also recommended that while reading illumination should be good and adequately arranged, posture should be easy and natural, avoid undue ocular fatigue, students should be taught about refractive error, it signs and symptoms along with consequences[10]. These recommendations of the previous studies had been covered in this study on prevalence of refractive error and its associated factors among school children.

1.2 Treatment of refractive error:

Refractive errors can be overcome by spectacles, contact lenses, or refractive surgery. The most commonly used form of refractive correction is by using spectacles, since they are the cheaper and simpler[3]. Developing countries have to face challenges in the form of availability and affordability of spectacles.

Inequities prevail in the availability of spectacles between developed urban and under-developed rural areas.

1.3 Initiatives related to refractive error:

VISION 2020: The Right to Sight [11][12]

VISION 2020 is a global drive that aims to eliminate avoidable blindness as a public health problem by the year 2020. This was launched on 18 February 1999 by the WHO together with the more than twenty international NGOs. These Non Governmental Organizations are involved in eye care and prevention and management of blindness that comprise IAPB. The programs and actions plans of VISION 2020 in India are aligned with NPCB. Elimination of avoidable blindness and VI due to URE is a major objective of VISION 2020**.** It is estimated that 80% of blindness is prevalent among people in developing world and of this, 80% which are avoidable blindness. There are approximately 45.5 million people who are visually impaired globally due to URE [13].

School eye health program under vision 2020: India school screening manual comprises of identifying and referring refractive error students with vision problems using suitable vision screening procedures, delivering high quality refractive services, ensuring availability of high quality, economic and appropriate optical services, regularized follow-up visits and procedures to assist identified students in receiving appropriate care, generate awareness among parents, teachers and students on refractive error and increasing compliance to use of spectacles. In

NPCB target for 12th five year plan, screening of school children for refractive errors and providing 4.4 million free spectacles to poor school age group children. National Rural Health Mission aids Modified School Health Program by funding and supporting to target all school-going children regardless of type of institution in the state of Tamilnadu. Under the MSHP, health visits to each school is scheduled to occur on a weekly basis. Both refractive error and hearing screening resulting in provision of spectacles and behind-the-ear hearing aids where needed are being implemented.

The School Health Programme is envisaged as an important tool for the provision of preventive and curative health services to the future generation.

Study Objectives

2. OBJECTIVES OF THE STUDY

Primary objectives:

1. To estimate the prevalence of refractive error in school children in the selected schools of Krishnagiri district

2. To identify the various risk factors associated with refractive error among the same study population

Secondary objective:

1. To assess the extent to which children with refractive error are wearing corrective spectacles.

Justification

3. JUSTIFICATION

1. Refractive error is the commonest cause of visual impairment in children. Under a public health perspective; vision screening becomes an important strategy to reduce vision impairment. Refractive error is a major cause of this and for which treatment is simple, effective, and inexpensive.

2. Reduced vision due to uncorrected refractive error remains a major public health problem in children going to school in India. It is a hard fact that 30% of India's blind population loses their sight before the age of 20 years, thus the importance of early detection and treatment of refractive errors in young becomes obvious[14].

3. School age is the earliest age at which refractive error begins. The school going years are the formative years for determining one's physical, intellectual and behavioural development. Any problem in the vision during the formative years can hamper the intellectual development, maturity and performance of a person in his future life.

4. Children usually refrain from complaining of defective vision and this becomes more pronounced if only one eye is involved. They may not even realise their problem. They adjust to themselves by sitting near the blackboard, bringing the book closer to their eyes, squeezing their eyes and even avoiding work requiring visual concentration and this evades early detection[15].

5. Myopia leads to visual impairment and blinding complications. Complications of myopia include pathologic conditions like myopic macular degeneration, choroidal neovascularisation, cataract and glaucoma. Quality of life (QOL) gets impacted like increased difficulty in performing vision-related tasks.

6. Children spending lot of time in front of TV or computers and this leads to tribulations in their vision. If the problems are unnoticed, they will suffer in future from visual impairment and they may even lose their vision completely. Visual impairment is an avoidable burden in the life of a child, his family and the society.

7. Myopia is one of the important cause of visual impairment which is usually acquired and progressive [16].

8. Children in the age group 10-14 years are in a position to understand the purpose and need for vision screening. Administratively it is easy to implement and the students can carry the message home thereby creating awareness in their respective villages[16].

School-age children are in the most vulnerable group, where uncorrected RE may have greater impact on learning capability and thereby educational quotient. RE prevalence and incidence data becomes imminent in planning awareness camps and vision screening. Utilization of corrective spectacles among school-age children are needed for eye health care planning.

Review of Literature

4. REVIEW OF LITERATURE

4.1. Prevalence of refractive error

4.1.1Global prevalence of refractive error [17]

In 2006, global magnitude of visual impairment due to uncorrected refractive error was included for the first time in WHO global estimates. It was accounting for about 153 million people. In this estimate, 13 million children aged between 5-15 years were affected globally. Thus, globally 314 million people were visually impaired due to eye diseases including uncorrected refractive errors and among them 45 million developed blindness.
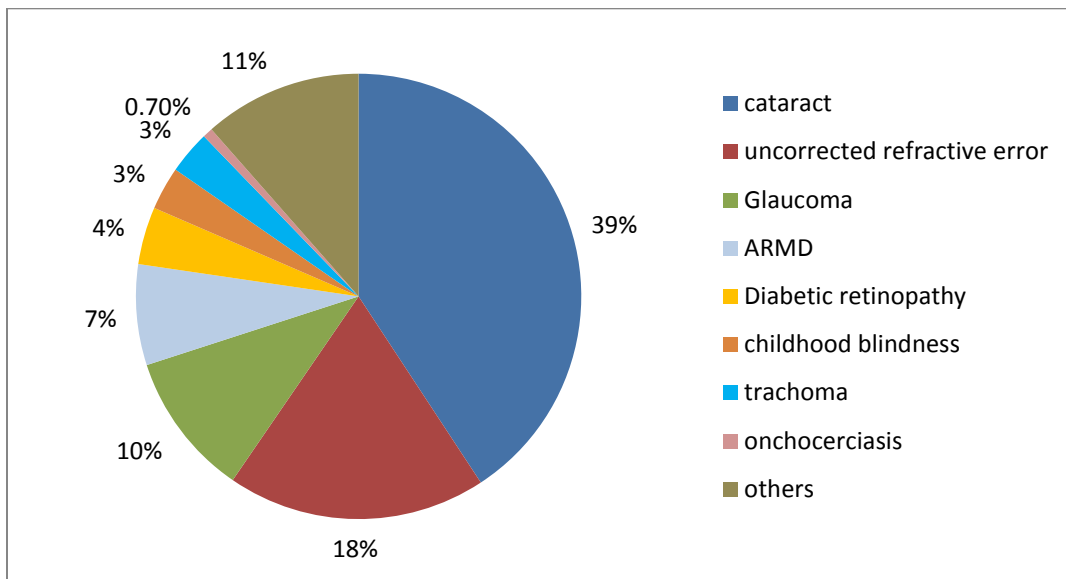
Figure 1: Global causes of blindness due to eye diseases

In a cross sectional study done by Shrestha et al to compare ocular morbidity between children attending government run and private driven schools of Kathmandu valley, the prevalence of ocular morbidity was 19.56% with refractive error constituting 11.9% among study population.[18]

A nationwide survey conducted by Lin LL et al in Taiwan in studying the prevalence and severity of myopia among school children, the rate of myopia ranged between 20% at 7 years, 61% at 12 years, and 81% at 15 years.[19]

A school based study on prevalence and analysis of astigmatism and its related epidemiological risk factors in Singapore, Louis Tong et al observed 19.2% prevalence of astigmatism. [20]

In a school based study done by Yi Sun et al in China, 90.3% students had refractive errors. The most common error was myopia followed by astigmatism and hyperopia was uncommon.[21]

Mutti et al conducted a study in Columbus to analyse the degree of association between juvenile and parental myopia, near work and school achievement. It has been observed that among the eighth grade children, the prevalence of myopia was 18.3% and hyperopia was 7.7%.[22]

Study on refractive errors among school going children in Pokhara city, Nepal was done by Niroula et al found the prevalence of refractive error as 6.43%. In this study, myopia was found to be higher with 4.05% than the hyperopia with 1.24% and only 1.14% of Astigmatism. [23]

Prevalence of myopia was 33 % in cross sectional study done by Chu et al in Taiwan school children. [24]

In a meta-analysis done by Castagno et al hyperopia prevalence decreases as age increases, with a summary prevalence measure of 5% at age 7, 2-3% between age 9 and 14 and around 1% at age 15.In studies using the 5-15 age group and $\geq$ +2.00 D (RESC) cut-off, hyperopia prevalence ranged from 2.1% to 19.3% [25]

4.1.2 Prevalence of refractive error in India

In a study done by Singh et al in 2013 to assess the status of refractive error in school children at Bhopal, prevalence of refractive errors was 13.09%. Among them prevalence of myopia was 7.09%, hypermetropia 4%, astigmatism 1.49% and amblyopia 0.49%. A total of 18500 children in the age group of 5-15 years who were randomly selected from urban and rural schools were included in this school screening. [26]

Prevalence of refractive error in school going children of Gujarat state capital of Ahmedabad city done by Sethi et al was 25.32% and distributed as 63.5% myopia, 11.2% hypermetropia and 20.4% of astigmatism. Among them 66.4% were aware about refractive error and the remaining 33.6% were unaware about the problem. [10]

In a cross sectional study done by Kamath et al, the prevalence of ocular morbidity was 74.29% among government school children and only 10.33% among private school children at rural Karnataka. Overall prevalence of refractive

error in this study was 5.6%. In government school the prevalence was 4.7% and in private school it was 6.5% [27].

In a school survey to assess the pattern of ocular morbidity among school children of central India was done by Singh et al in various schools during the period of Nov 2004 to Dec 2007. Complete ocular examination was done for school children in the age group of 5 to 16 years. Visual acuity of <6/9 and improving with pinhole was considered to be refractive error. In this study, prevalence of ocular morbidity was 14.5%. The most common ocular morbidity was refractive error (47.91%) and 8 to 12 years was the most common age group affected with ocular morbidity. Among those children with refractive error, 65.53% had uncorrected visual acuity of 6/9 to 6/18 and 5.67% had uncorrected vision <6/60 causing severe visual impairment. [28]

Amol Bansal et al had done a school eye health survey in Kolar district of South India to detect prevalence of ocular morbidity among school going children. Two government schools and two private schools were randomly selected and in this school based survey, the overall prevalence of ocular morbidity was 13.3%. The major cause of ocular morbidity in this was refractive error with prevalence of 11.9%. Other causes are Vitamin A deficiency, conjunctivitis, amblyopia, squint, blepharitis. [29]

In 2013, a cross sectional study done by Naik et al to estimate prevalence of ocular morbidity among school going children in Maharashtra, refractive error

7.57% constitutes the major cause of ocular morbidity followed by squint and colour blindness(0.18%), vitamin A deficiency (0.36%),traumatic eye disorders(0.5%),congenital disorders (0.2%).Myopia was a more common disability than hypermetropia. Myopia and myopic astigmatism were absent under the age of 7 years. As age advances, incidence is on the rise. Myopia was at 4.8% in those 8–10 years of age, which went four times higher at 11–13 years (18%), and which got doubled again at 14–16 years of age (33%). Myopic astigmatism had shown the same trend (6% to 15.6%) between those age groups. This is against hypermetropia which did not show such an increasing trend.[30]

In a study of ocular morbidity in school children in Mysore district done by Prakash et al, ocular morbidity was seen in 1044 (5.4%) children. Among the ocular morbidity, uncorrected refractive errors were the most common condition is seen in 518 (49.6%) children, followed by others (49.9%) which included squint, blepharitis, external hordeolum, red eye, followed by corneal blindness (0.19%), cataract (0.19%), and vitamin A deficiency (0.095%). [31]

A cross sectional study was conducted by Deshpande Jayanth et al to assess the ocular morbidity among school going adolescents studying between class 5 to class 10 in the age group 10-16 years in rural area of Maharashtra. Prevalence of ocular morbidities was found to be 27.65 %. Uncorrected refractive errors constituted the most important cause of subnormal vision. The commonest cause of ocular morbidity in the present study was refractive errors with a prevalence of 10.12%. [32]

In a study of ocular morbidity prevalence among school children in Shimla, Gupta et al had found ocular morbidity prevalence of 31.6%. Refractive error constitutes 22% and colour blindness 2.3%. [33]

In a community based refractive error study done by Dandona et al among children in a rural population of Andhra Pradesh, prevalence of hyperopia was 0.78% and 4.1% had myopia. [34]

In a study done by Prema to assess the prevalence of refractive error and its causative factors among seventh standard school students in Tamilnadu, 37.39% had refractive error.[35]

In rural Puduchery, Suba Joice et al assessed the nutritional status and morbidity pattern of school children, about one fifth of the children (20.9%) had refractive errors. [36]

In a school based cross sectional study on prevalence of refractive error in Tiruvallur district, Tamilnadu done by Chandramohan et al, 7% had refractive error in both eyes and 9 (3%) had only in left eye and 6 (2%) only in right eye.[37]

4.2. Refractive error and Socio demographic factors

In a study done by Lin LL et al in Taiwan, girls shown higher prevalence trend in myopia than boys. Children belonging to urban areas had a higher prevalence and more severe degree of myopia than children pertaining to rural areas. [19]

In china, a study by Sun et al observed that as the age increases, it was closely associated with increased risk of myopia in multivariate models. Boys on

average had more myopic refractive error compared to girls, and the difference was statistically significant (p=0.0397). The prevalence of myopia among boys was 88.2 % and that of girls was 84.7% .[21]

Niroula et al observed that in their study in Nepal, boys (7.59%) were found to have suffered from refractive errors than girls (5.31%).[23]

In a school based study in Singapore done by Louis tong et al, astigmatism prevalence was not different between genders, ethnic groups or age (p > 0.05). Also type of housing, income and father's education level were not significantly related to

astigmatism (p > 0.05).[20]

In a cross sectional study done by Chu et al in Taiwan school children, Girls had a higher incidence odds ratio (1.37) of myopia compared with boys (p < 0.01). Students in grades between 4 and 7 had significantly higher odds ratios (3.68 and 6.00, respectively) of myopia compared with students in 1st grade (all p < 0.01). Students belonging to sub-urban and rural areas had significantly lower odds ratios (0.44 and 0.39, respectively) of myopia compared with students pertaining to urban area (all p < 0.01). [24]

Saw et al in their study related to near work and early onset myopia in Singapore observed that consistent with the development of myopia, the prevalence rates increased with age (27.6% at age 7 years, 34.6% at age 8,and 43.2% at age 9). There were positive associations between higher myopia prevalence rates and

larger housing type, higher family income, more advanced father's and mother's education ($P < 0.001$, for each). Housing type, family income, and parental education are all likely surrogates for socioeconomic status.(38)

In the study of refractive error in school screening survey done in Bhopal by Singh et al, prevalence among boys was 5.72% and among girls (7.36%) it was higher. The children with decreased visual acuity were more common in the children from rural schools, when compared to urban schools.[26]

A study on prevalence of refractive error in school children of Ahmedabad city done by Sonam Sethi et al observed that females had 23.9% prevalence and males with 26.7% prevalence rate and this difference was not statistically significant Chi square value=1.34 and p value > 0.25. Refractive error increased with age with only 1.4% prevalence at 5 years of age, increasing to 13.8% at 10 years, 18.4% at 11 years, 23.5% at 12 years, 17.7% at 13 years and again decreased to 5.1% at 14 yrs. Mean age of onset in this study was 11.22+ or − 2.07, median and mode age of 12 years. Also refractive error increased as the child move to higher class and significant relation was found between refractive error and educational level.[10]

In the study done by Kamath et al in Karnataka, prevalence of refractive error prevailed as 9.72% among primary school children, 27.78% among middle school and a maximum of 62.50% among high school children. This was highly significant statistically (χ^2=95.85, p<0.001). This shows proportionate increase in

the prevalence of refractive error was seen among both the government run and private run school children. [39]

In a study conducted by Amol Bansal et al in Karnataka, the prevalence of refractive error in boys was 12.1% and in girls it was 11.7%.[29]

A significant decreasing prevalence of ocular diseases as one climbs up the socio economic ladder (p<0.001) was observed in a study by Deshpande Jayanth et al and is said to be due to improved nutrition and hygiene. In the same study, a significant association was found between education of parents and refractive error. [32]

A school based study done by Nitin Batra et al observed that girls had higher prevalence of refractive error than boys and this difference was statistically significant for myopia p<0.01, hyperopia p<0.01and astigmatism p<0.003. Also statistically significant association was found between decreased vision and increasing age. The prevalence of refractive errors was higher in urban schools and the difference was statistically significant p<0.001. [40]

In a study done by Dandona et al in 2002 myopia was associated with gender disparity more with female (odds ratio [OR], 1.46; 95% CI, 1.04%−2.06%), older age group (OR, 1.10; 95% CI, 1.00%−1.20%), and increasing levels of schooling of the father (OR, 1.48; 95% CI, 1.16%−1.89%). The years of schooling of the child were not significant (P =0.633) in the analysis. In regression modeling for severe myopia, schooling of the father was associated with an

increased risk. No significant associations were found in the multiple-regression modeling for hyperopia.[34]

In school based survey done by Chandramohan et al, refractive error was more among male children (21.5%) than the female children (17%).[37]

4.3. Factors associated with refractive error

4.3.1 Type of school

A study by Shrestha et al observed that the difference in the prevalence of refractive status found in the students from government and private schools is not statistically significant.[18]

Higher Prevalence of refractive errors were found in private trust run school children (9.29%) than government school children (4.23%) in a study by Niroula et al which is statistically significant (P < 0.05). it was said that the children of higher socioeconomic status of private schools spent more time watching TV; spend more time in study related activities, staying indoors and computer as compared to government school children. These activities may cause strains and stress on eyes of the children and might be the primitive factors for developing near vision. [23]

Kamath et al observed that refractive error was the commonest problem among the private school going children (6.5%) and all of them were detected and treated. While refractive error among the government school children was to the extent of 4.7% and none of them were detected and treated. [39]

In a study conducted by Amol Bansal et al in Karnataka, the prevalence of refractive error in government schools was 12.1% and in private schools it was 11.8%.[29]

4.3.2 Parental history of refractive error

It has been observed in a study by Yi sun et al in China that prevalence of myopia was common in people who had parental history of myopia (p=0.002). [21] Mutti et al study on school children reported that parents diagnosed with myopia tend to have children with myopia (chi square = 21.0; P = 0.001). Of the children born in families with both parents with myopia, 32.9% had myopia compared with 18.2% of the children in families in which only one parent was myopic and 6.3% of the children in families with no parents with myopia. [22]

Saw et al in their study on near work and early onset myopia in Singapore observed that statistically significant relation was present between refractive error and parental myopia. p value <0.001.[38]

In a study done by Prema et al in southern state of Tamilnadu, there was significant association between different Refractive Errors and Parents with a glass history with Chi square value of 42.38 and p value <0.001. If any of the parent or both wearing glasses, their children found to have defective vision. The children had lesser problem in vision compared to earlier group.[35]

In the SMS study, parents with myopic history had two times and eight times higher risks, respectively, of developing myopia (SE of 0.5 D) compared to

those with no myopic parents. In addition, an up-rise in severity of parental myopia had resulted in higher trends.[41]

The SCORM cohort showed similar trends as above indicating that having one and two   parents with history of myopia was associated with an increase in AL of 0.14 and 0.32 mm, respectively, compared with no myopic parents. The study also showed that having one myopic parent and two myopic parents increased the degree of myopia by 0.39 and 0.74 D, respectively[42].

Role of parental myopia led to direct impact on myopia in their wards in progression of error and its interaction with treatment in COMET children done by Kurtz et al.[43]

4.3.3 Visual tasks / near work activities

Yi sun et al observed that short vision students studying 4.5 hours per week than n students (p = 0.013) with no short vision. Indoor activities were found to be similar in both myopes and non-myopes.[21]

In a study by Mutti et al showed that those children playing less sports and staying indoors were myopic (*p*=0.0003), compared with emmetropes. Watching television and playing video games or working on the computer at home did not differ between myopes and emmetropes. Myopes were spending more time reading for pleasure (*P* _ 0.034) and less time playing outdoors(*P* _ 0.049) than hyperopes [22]

Saw et al in their study on near work and early onset myopia in Singapore reported children   reading more than 2 hours per day reported odds ratio 2.16

(95% CI, 1.34–3.47), and the multivariate adjusted odds ratio was 1.50 (95% CI, 0.87–2.55).Children who went to tuition classes had two times more chances of developing myopia. Similarly, children on a regular desktop use had a two times higher rate of higher myopia.[38].

In a cross sectional study done by Prema, a significant association was found between refractive error and near work with Chi square value of 35.57and p value<0.001. Many of the children who spend more than two hours on systems and TV a lot are affected by refractive error than the children who use the same, for less than two hours.[35]

Study on role of near work in myopia in Australia done by Ip et al observed that children who study continuously for more than half an hour had higher chances of developing near vision compared to others. Meanwhile, children who performed near-work at a distance of less than 30 cm were two and half times more likely to have myopia than those who worked at a lengthier distance. Similarly, children who spent longer time reading story books and those who read at a distance closer than 30 cm were more likely have higher myopic refractions.[44]

4.3.4 Outdoor activities

Rose et al in Australia observed that students who spent more time doing indoor activities like studying, reading, watching TV and spending more time on system developed myopia. On the other hand, those who carried out activities playing outdoors and physical activities had hyperopic mean refraction.

Furthermore, in an analysis combining the amount of both outdoor activity and near work activity spent, children with low outdoor time and high near work were two to three times more likely to be myopic compared to those performing low near work and high outdoor activities.[45]

In Singapore, a cross-sectional study was conducted by Dirani M et al and the result showed that the mean total time spent on outdoor activity was 3.24 h/day. The total outdoor activity (h/day) was significantly associated with myopia, odds ratio 0.90(p = 0.004), after adjusting for age, gender, ethnicity, school type, books read per week, height, parental myopia, parental education and intelligence quotient. In addition, the total time spent outdoors was associated with significantly less myopic refraction, p<0.001 and shorter axial length. Total sports was also significantly negatively associated with myopia (p = 0.008) but not indoor sports (p = 0.16)[46].

Prema in her study on causative factors for refractive error observed that a statistically significant inverse association was found between refractive error and outdoor activities with Chi square value of 10.89 and p value= 0.001.Children who play less outside or do any work in the outside for more than two hours are affected by refractive error than the number of children who are doing the same, for less than two hours.[35]

4.3.5 Nutritional status

In the cross sectional study by Deshpande Jayanth et al, 28.94% children were underweight i.e. $<5^{th}$ percentile of BMI. A statistically significant association was found between ocular morbidity and malnourished children. [32]

In a cross sectional study done by Chu et al in Taiwan school children, in univariate analysis myopia was statistically significant with BMI p=0.03.[24]Saw et al observed that in Singapore Chinese children, refractive error was associated with height and was significant in girls but not in boys. Also hyperopia was found more in obese children but this association was present in boys but not in girls.[47]

Materials and methods

5. MATERIALS AND METHODS

5.1 Study design:

This study was conducted as a school based cross sectional study to estimate the prevalence of refractive error and its associated factors among school children in selected schools of Krishnagiri, Tamilnadu.

5.2 Study area:

The school based study was conducted in selected schools of Krishnagiri, Tamilnadu, India.

5.3 Study period:

The study was carried out from January 2015 to August 2015.

5.4 Study population:

The study population comprised of students in the selected schools of Krishnagiri district. All the students in the sixth to eighth standard were included in the study.

5.4.1 Inclusion criteria

- All boys and girls of 6th to 8th standard in selected schools of Krishnagiri district

- Those parents who are giving informed consent

5.4.2 Exclusion criteria

- Absentees on the day of data collection

5.5 Sample size calculation

The sample size is calculated based on estimated mean prevalence of 10%. Considering confidence interval of 95%, absolute precision of 3% with 10 % excess sampling to account for non-response, the sample size derived is 422.

Sample size is calculated using the formula:

$$N = Z_{1-\alpha}^2 pq/d^2$$

Where, $Z_{1-\alpha}$ = standard normal deviant at 95% confidence level i.e. 1.96

p = prevalence =10%

q= 100-p= 90%

d = absolute precision of 3%

$N = (1.96)^2 *10* 90/ (3)^2 = \sim 384$

Allowing a 10% non-response rate the sample size comes around 384+38= 422.

5.6 Sampling method:

Multistage sampling method was used.

- **First Stage:** Two blocks were selected by simple random sampling method from 10 blocks of Krishnagiri district.

- **Second Stage:** 1government school and 1 private school from each block were selected by stratified sampling method.

- **Third stage:** All the students from sixth to eighth standard in the selected schools were included in the study.

5.7 Measuring tools

1. Pretested semi-structured questionnaire

2. Anthropometry

3. Screening of vision

5.7.1 Questionnaire

Questionnaire for the present study was developed based on previous review of literature. It was validated with the help of pilot study. It was translated into Tamil and again back translated to English to ensure that the meaning of the message conveyed did not vary. (Annexure 3)

It consists of socio demographic details of the individual and the family, history related to refractive error, parental and sibling history of refractive error, time spent in near work and outdoor activities. Based on the observations from pilot study, necessary modifications were made for the main study. The results from the pilot study were not included in the final analysis.

5.7.2 Anthropometry:

Height was measured without footwear with feet together standing as tall as possible and looking straight ahead using a portable stadiometer. Weight was

measured using a portable weighing machine. The scale was set at zero before weighing each person and the study subject was asked to stand on it without any footwear and looking forward.

5.7.3 Screening of vision

A separate room was arranged for screening of vision in the respective schools. Vision screening was done with the help of experienced Optometrist in the schools under the supervision of investigator. Snellen's chart for distant vision was used for testing visual acuity placed at a distance of six meters. The right eye is tested first for visual acuity then the left eye, each time occluding the fellow eye. Jaeger's chart for near vision was tested by keeping 25-30 cm distance from the eyes of the subjects. If the child wears spectacles, visual acuity was tested both with and without spectacles. The refractive errors were screened. Ishihara's isochromatic chart was used to identify the cases of colour blindness.

5.8 Data collection and methods:

a. Data collection was done in the study area after obtaining official permission from the Director, Institute of Community Medicine and the Dean, Madras Medical College, District Elementary Educational Officer, Krishnagiri and approval from the Institute Ethics Committee (Annexure 10).

b. The principals of the schools were consulted and a convenient date was fixed for examination of eye and also for parents meeting. Children were instructed to bring the spectacles on the day of examination without fail. Parents were

explained about the study and importance of screening of vision in school children and the associated risk factors. Informed consent was obtained from the parents.

c. Details regarding the students' near work (such as reading for school assignment, watching TV, using computers, reading books other than subjects and video games), the time spent for playing outdoor games and parental history of wearing spectacles were collected from their parents by administering the pretested questionnaire.

d. General data regarding the age, sex, address, history related to refractive error was collected by interviewing the child and entering in the pre-tested semi-structured questionnaire by the investigator followed by the anthropometric measurement and screening of vision of the child.

e. A short talk supported by charts, posters and audio visual tapes regarding eye health education was given to children after general and ophthalmic examination.

f. At the end of the screening, school heads and their parents were informed about the refractive status of the children and also the importance of early correction with spectacles and regular use of it.

5.9 Statistical Analysis:

The collected data was entered for analysis in Microsoft Excel. This data was exported to Statistical Package for Social Sciences software version 21 for analysis. Descriptive statistics (mean, standard deviations and range) were employed to describe continuous variables, while frequency distributions were

obtained for dichotomous variables. Associations between qualitative variables were done using Chi square tests, Fisher's exact test; correlation and regression. Odds ratio and their confidence intervals were calculated to assess the estimate of the risk. A p value of less than 0.05 has been considered to be significant.

5.10 Variables of interest and operational definitions:

1. Refractive errors include myopia (short-sightedness) and hyperopia (long-sightedness) with or without astigmatism (when the eye can sharply image a straight line lying only in one meridian)[48]. **Myopia** is a condition where objects up close appear clearly, while objects far away appear blurry. With myopia, light comes to focus in front of the retina instead of on the retina. **Hypermetropia** is a condition where distant objects may be seen more clearly than objects that are near. The light rays get focussed behind the retina. Astigmatism is due to an imperfect shaped cornea and lens. With the result, the image on the retina is elongated or flattened.

2. Socio Demographic Variables:

Age: Completed age in years at the time of interview was considered for the study.

Sex: Sex was recorded as male or female

Religion: Includes (1) Hindu, (2) Muslim, (3) Christian (4) others.

3. **Socio- Economic Status:** The socio-economic status was classified based on Modified B.G. Prasad Classification, 2015 (Annexure 4)

4. **Skilled worker**: As per Minimum wages act, skilled employee is one who is capable of working independently, efficiently and accurately. An individual who is knowledgeable about a specific skill or trade.

5. **Semi-skilled worker**: As per Minimum wages act, Semi-skilled employee is one who has sufficient knowledge of the particular trade or above to do respective work and simple job with the help of simple tools and machine.

6.. **Un-skilled worker:** As per Minimum wages act, Un-skilled employee is one who possesses no special training and whose work involves the performance of the simple manual tasks, which may be quickly learned and has no identifiable skill.

7. **Tuition** supplemental instruction outside school, termed "tuition" classes; children spend the majority of the time reading or writing during these classes.[38]

Results and analysis

6. RESULTS AND ANALYSIS

In this cross sectional study totally 422 school children in randomly selected schools of Krishnagiri, were included to estimate the prevalence of refractive error in school children and also the associated factors for the disease in the study population.

The data collected was analysed using SPSS.

> ➢ Simple frequency test was done for socio demographic details of the study population – age, sex, education, religion, socio economic status and type of family, education and occupation of parents.

> ➢ Then the prevalence of refractive error and its association with socio demographic variables and association with other risk factors like parental history of refractive error, near work activities, outdoor activities, continuous reading time, and reading posture among the study participants were found.

> ➢ Multiple logistic regression

> ➢ Then prevalence of using corrective spectacles among those with refractive error was also found.

6.1 SOCIO DEMOGRAPHIC DETAILS OF STUDY POPULATION:

6.1.1: Age and Gender distribution of study population

Among the study participants, 18 (4.3%) were 10 years old, 123(29.1%) were in the age of 11 years, 139(32.9%) were in 12 years of age, 119(28.2%) were 13 years old, 23(5.5%) were in the age of 14 years.

Table 1: Age distribution of the study participants

Age in years	Number of participants(N=422)	Percentage
10	18	4.3
11	123	29.1
12	139	32.9
13	119	28.2
14	23	5.5
Total	**422**	**100**

Table 2: Gender distribution of study participants

Gender	Number of participants(N=422)	Percentage
Boys	238	56.4
Girls	184	43.6
Total	422	100

Table 2 shows that among the study participants, 56.4% (238) were boys and 43.6% (184) were girls.
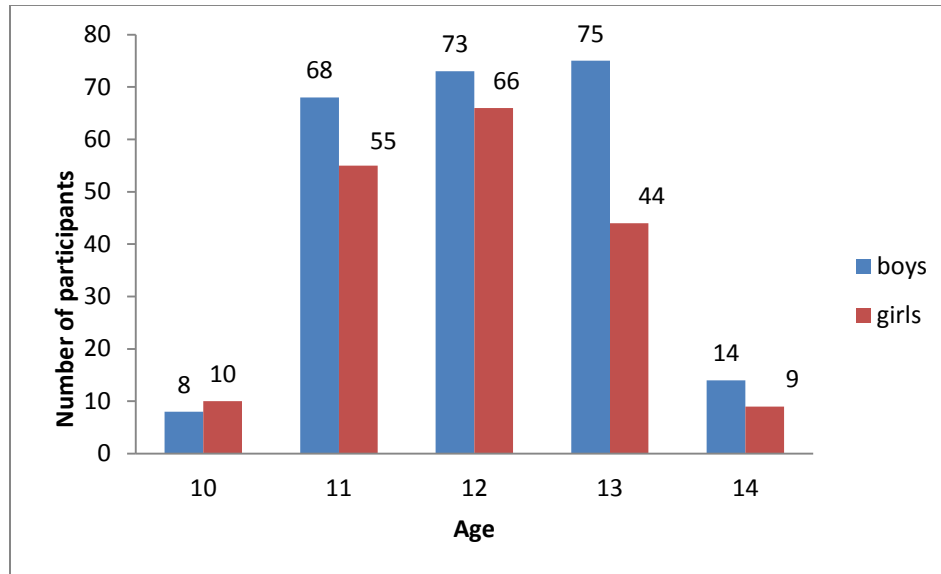
Figure 2: Age and gender distribution of study participants (N=422)

Figure 2 shows the age and sex distribution of the participants. Males were predominating in all age except 10 years.

6.1.2 Distribution of Religion among the study participants

Table 3: Distribution of Religion among the study participants

Religion	Number of participants(N=422)	Percentage
Hindu	411	97.4
Christian	4	0.9
Muslim	7	1.7
Total	**422**	**100**

Among the study participants, 97.4% were Hindus, 1.7% Muslims and only 0.9% belonged to Christian religion.

6.1.3 Type of School and class among the study participants
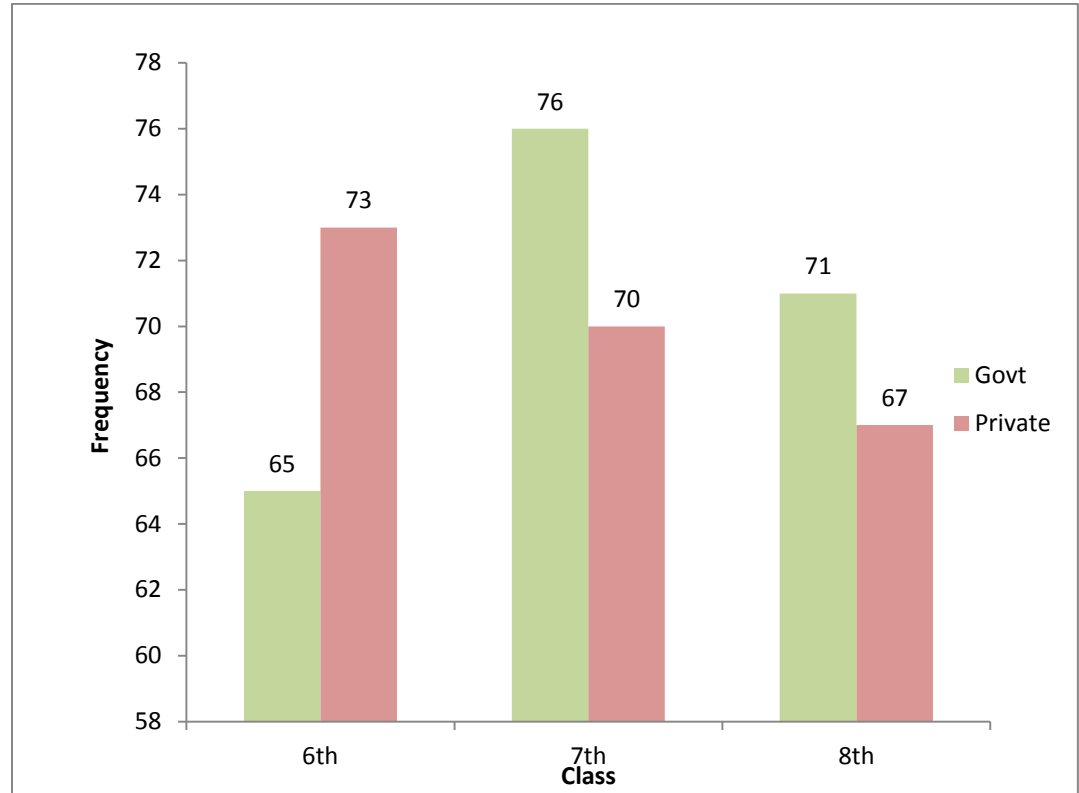
Figure 3: Type of School among the study participants

Figure shows overall there was equal distribution of participants in both Government and Private schools, 32.7% of participants were in sixth, 34.6% of participants were in seventh and 32.7% of participants were in eighth class.

6.1.4 Gender distribution and type of School

Figure 4 shows that in government schools 53.8% were males and 46.2% were females. In private schools, 59% were males and 41% were females among the study participants.
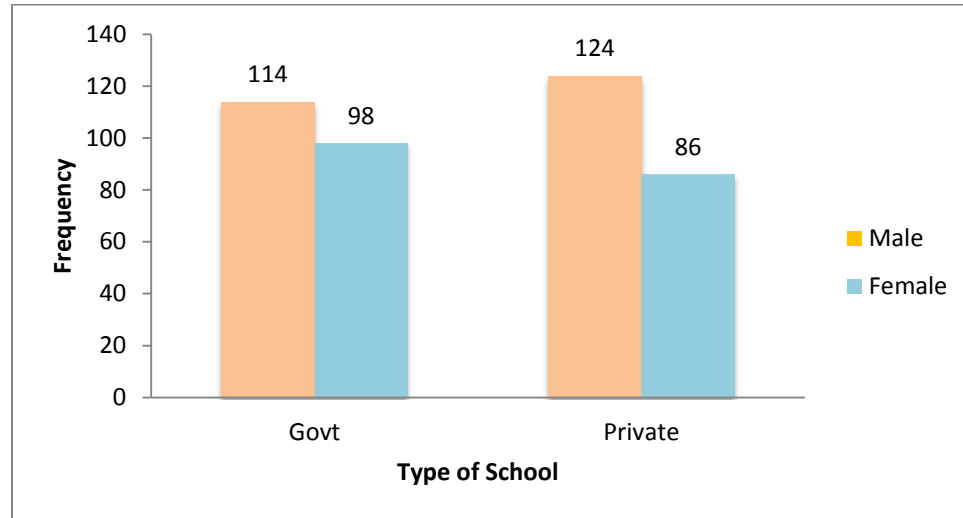
Figure 4: Gender distribution and type of School

6.1.5 Type of family among the study participants

Table 4: Type of family among the study participants

Type of family	Frequency	Percentage
Nuclear	292	69.2
Three generation	113	26.8
Joint family	17	4.0
Total	**422**	**100**

Table 4 shows that among the study participants, only 4% belonged to joint family. Majority of the participants were from nuclear family (69.2%) and 26.8% belonged to three generation type of family.

6.1.6 Socioeconomic status of the study participants

Table 5: Socioeconomic distribution of study population

Per capita income (Rs./m)	SES	Number of participants (N=422)	Percentage
>6003	Class I	29	6.9
3002-6002	Class II	73	17.3
1801-3001	Class III	105	24.9
901-1800	Class IV	152	36.0
<901	Class V	63	14.9
	Total	**422**	**100.0**

Socioeconomic classification was done based on Modified BG Prasad scale for July 2015 (Annexure 4) by calculating the per capita income from the total family monthly income divided by total family members. From the table 5 , it shows that only 6.9% belonged to class I, 17.3% belonged to class II, 24.9% belonged to class III, 36% to class IV and 14.9% to class V.

6.1.7 Education of the parents

It has been observed that 2.2% of the fathers and 5.5% of the mothers of the study participants had no formal school education. Primary school education level was attained by 12.9% of fathers and 11.6% of mothers. 22.7%, 44.3% of mothers and 17.5% and 50% of fathers had gone up to middle school level and secondary/higher secondary school level respectively. 17.5% of fathers and 15.9% of mothers had completed a graduation degree. (Figure 5)
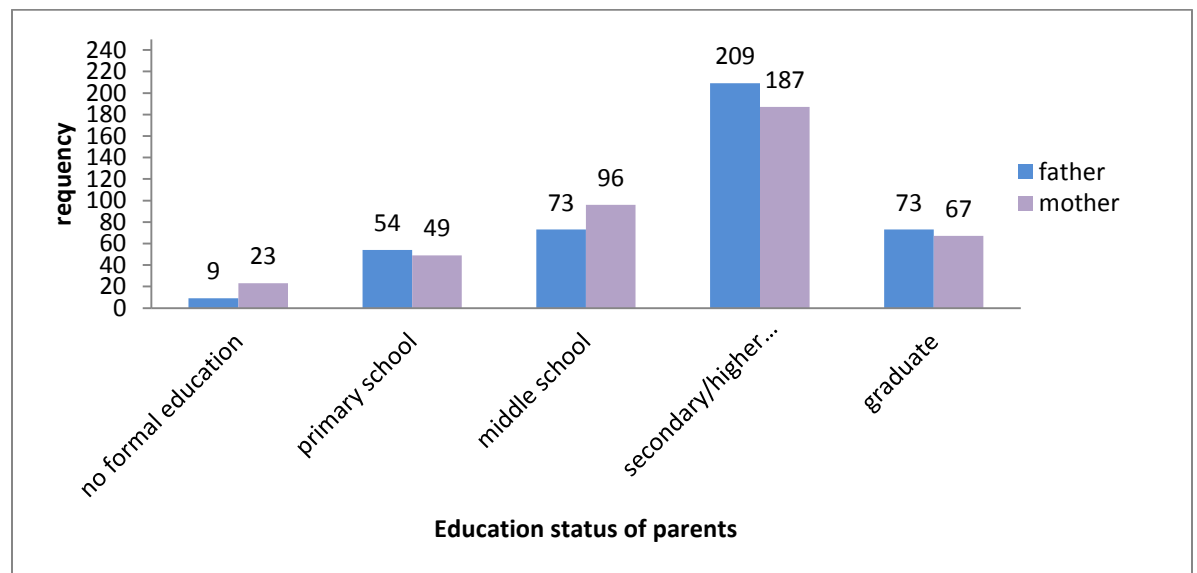
Figure 5: Educational status of parents

6.1.8 Occupation of the parents

In the current study, 60.8% of fathers were unskilled labours and only 1.2% of the fathers were semi-professionals.

Table 6: Occupation of the father

Occupation of father	Frequency (N=418)	Percentage
Unskilled	254	60.8
Semi-skilled	69	16.5
Skilled	90	21.5
Semi professional	5	1.2
Total	**418**	**100.0**

Table 7: Occupation of the mother

Occupation of mother	Frequency(N=422)	Percentage
Working mothers	42	10.0
Home makers	380	90.0
Total	**422**	**100.0**

It has been observed that only 10% (N=42) of the mothers were working

6.2 Prevalence of Refractive error

6.2.1 Prevalence of refractive error among participants:

38
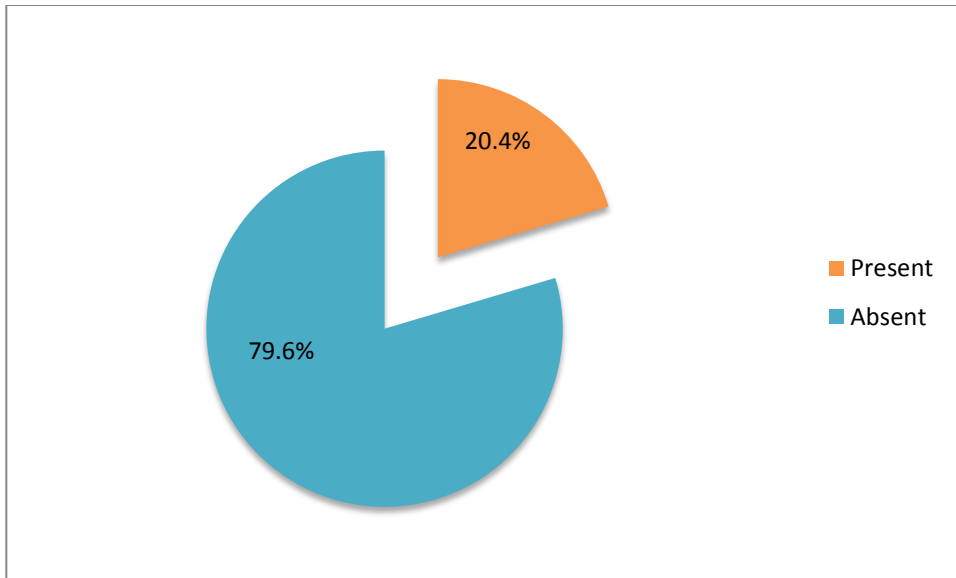
Figure 6: Prevalence of Refractive error among participants (N=422)

Among the four schools visited (N=422), 86 school children (20.4%) had refractive error with 95% C.I. of 12.86 to 27.94 and the remaining 336 school children (79.6%) did not have any refraction problems in both the eyes.
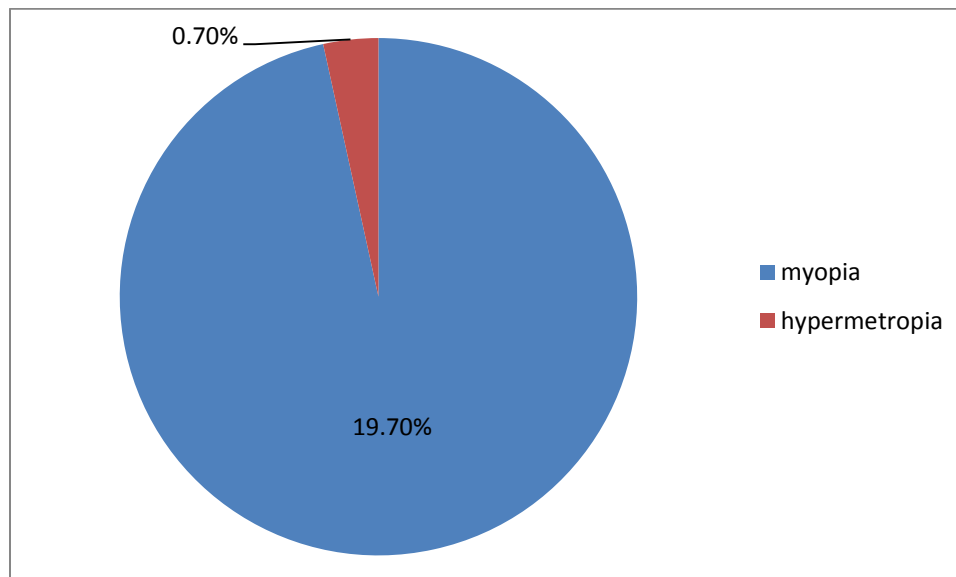
Figure 7: Type of refractive error among study participants

Among the study participants, 19.7% had myopia and only 0.7% had hypermetropia.

6.2.2 Prevalence of symptoms related to Refractive error among the study participants

Among the 86 participants with refractive error, 61 (70.9%) had complained. The most common symptom was blurred vision (26.7%) followed by double vision (15.1%), headache (11.6%), irritation, watering, pain and redness.

Table 8: Prevalence of symptoms related to Refractive error

Symptoms of RE	Number of participants (N=86)	Percentage
Double vision	13	15.1
Blurred vision	23	26.7
pain	5	5.8
Irritation	4	4.7
Redness	3	3.5
Watering	3	3.5
Headache	10	11.6
Total	**61**	**70.9**

6.2.3 Prevalence of spectacle usage among study participants

Among the study participants, 20.4% (N=86) children were identified as having refractive error. But only 18.6% (N=16) of those with refractive error were already diagnosed and using corrective spectacles for refractive error, remaining (81.4%) were not aware of their problem.
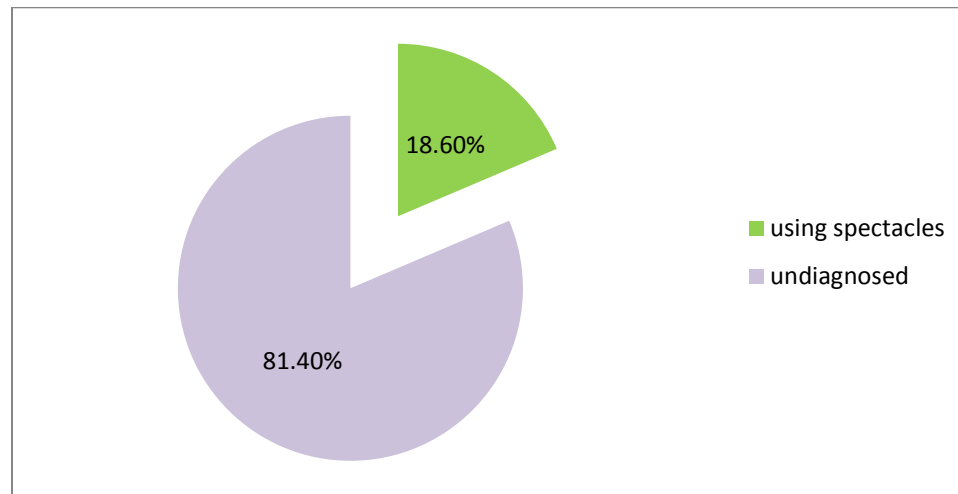
Figure 8: Prevalence of using corrective spectacles among those with refractive error

It has also been observed that among those using corrective spectacles (N=16), 81.3% (n=13) were using it regularly. The reasons for irregular usage of corrective spectacles observed among the study participants were getting teased by others and spectacles getting dirty.

6.3 Distribution of risk factors among study participants

6.3.1 Distribution of parental history of refractive error

Among the participants, 14.9% (N= 63) had parental history of refractive error with 8.5% among fathers only, 4.7% among mothers only and 1.7% among both the parents.

Table 9: Distribution of parental history of refractive error

Parental history of refractive error	Number of participants (N=422)	Percentage
Father	36	8.5
Mother	20	4.7
Both	7	1.7
None	359	85.1
Total	**422**	**100.0**

6.3.2 Distribution of sibling history of refractive error

Figure 9 shows that among the study participants, only 6.4% (N=27) had sibling history of refractive error in the family.
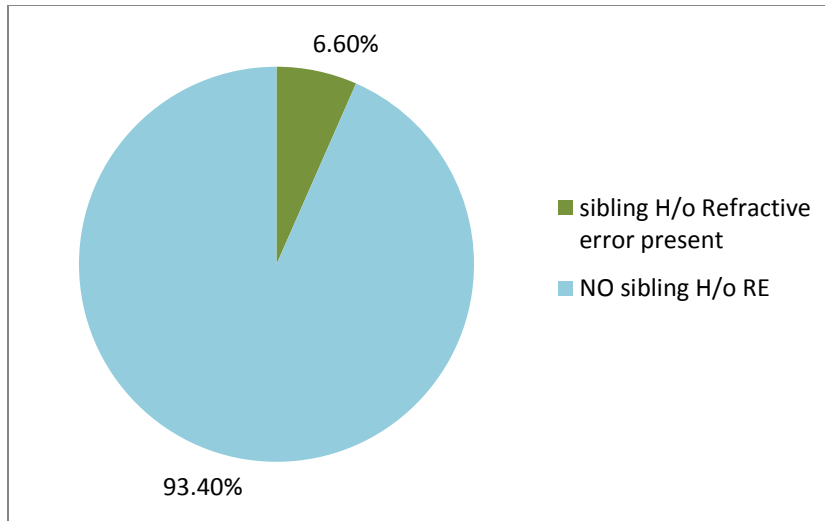
Figure 9: Distribution of sibling history of refractive error (N=409)

6.3.3 Distribution of time spent in doing school homework

In the study, 44.4% of the students were spending 1hr/day in doing school work, 21.9% of the participants were spending 2hr/day, 15% were spending >2hr/day, 9.5% were spending 30 min/day and 9.3% were spending 1.30 hr /day.
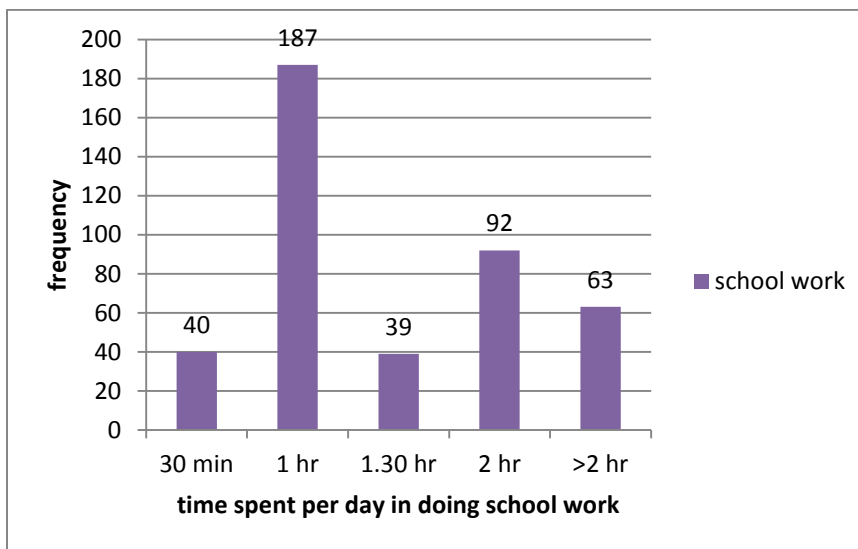
Figure 10: Distribution of time spent per day in doing school work (N=421)

6.3.4 Distribution of time spent in reading other books

In the study, only 177 participants responded for this question. Among them, 78% were spending 30 min/day, 19.2% were spending 1 hr/day and 1% in 1.30 hr/day and 1.7% spending 2hr/day in reading books other than school books.
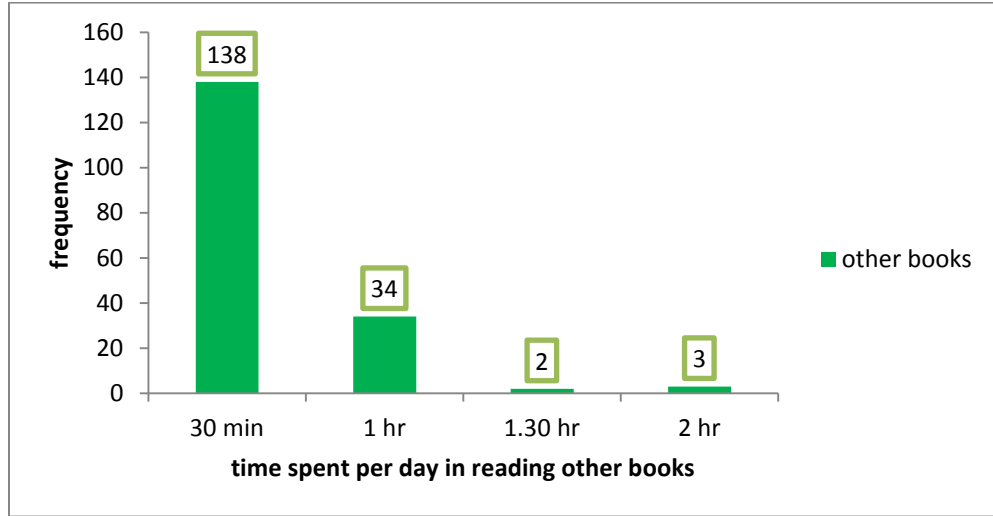
Figure 11: Distribution of time spent in reading other books (N=177)

6.3.5 Distribution of time spent in watching TV
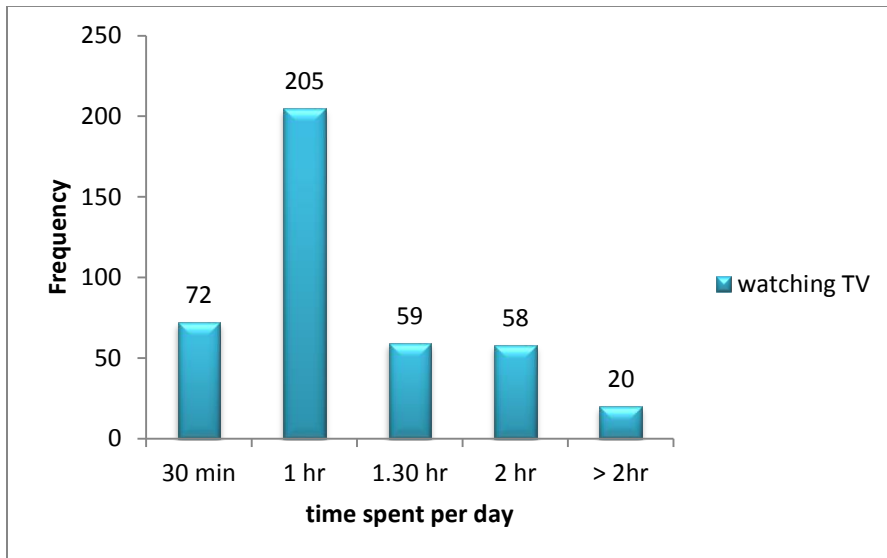
Figure 12: Distribution of time spent in watching TV (N=414)

Figure 12 shows that among the study participants, 49.5% were spending 1 hr/day,17,4% were spending 30 min/day , 14,3% were spending 1.30 hrs/day, 14 % spending 2 hr/day and 4.8% were spending >2 hr/day in watching television.

6.3.6 Distribution of time spent on playing mobile/video games

Among the study participants, 45.3% were playing mobile/video games for about 30 min/day. 48.1% were not playing mobile/video games.

N=219
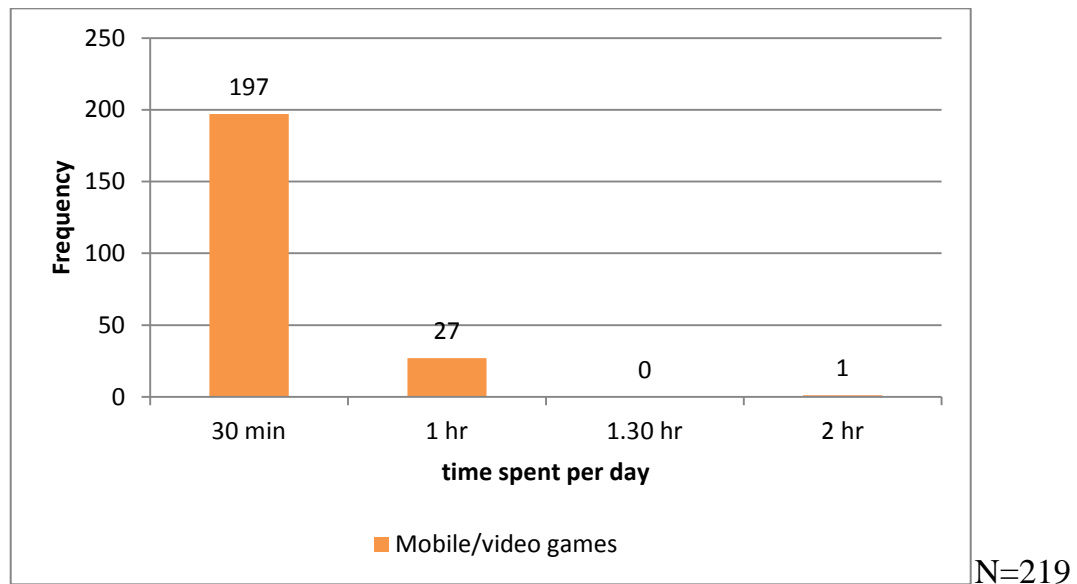
Figure 13: Distribution of time spent on playing mobile/video games

6.3.7 Distribution of time spent in using computer/lap

It has been observed that in the study participants, only 10.2% had access to computer/lap. Among them 74.4% were using computer for 30 min/day.
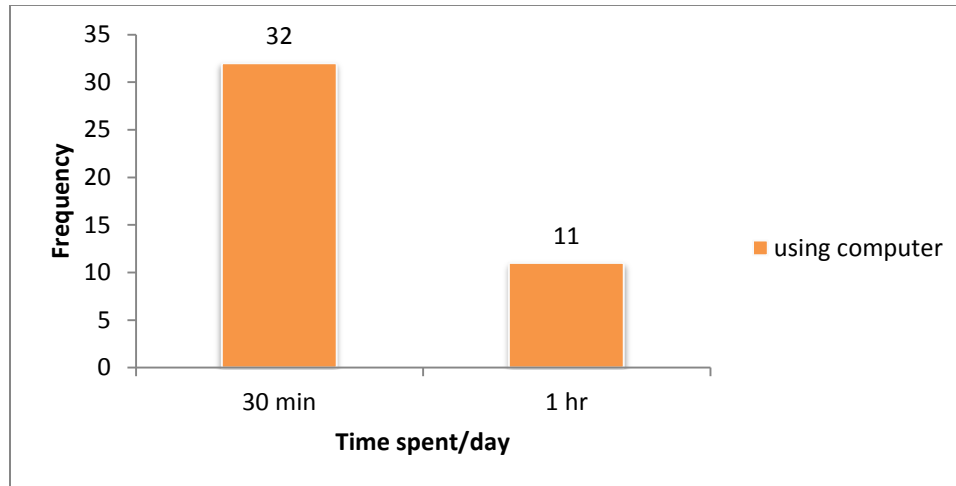
Figure 14: Distribution of time spent in using computer/ lap (N=43)

6.3.8 Distribution of time spent in playing outdoor activities

Figure 15 shows that 10.7% of the study participants were not spending time in playing outdoors. 30.1% of the participants were spending 30min, 48.6% were spending about 1hr per day in playing outdoors.
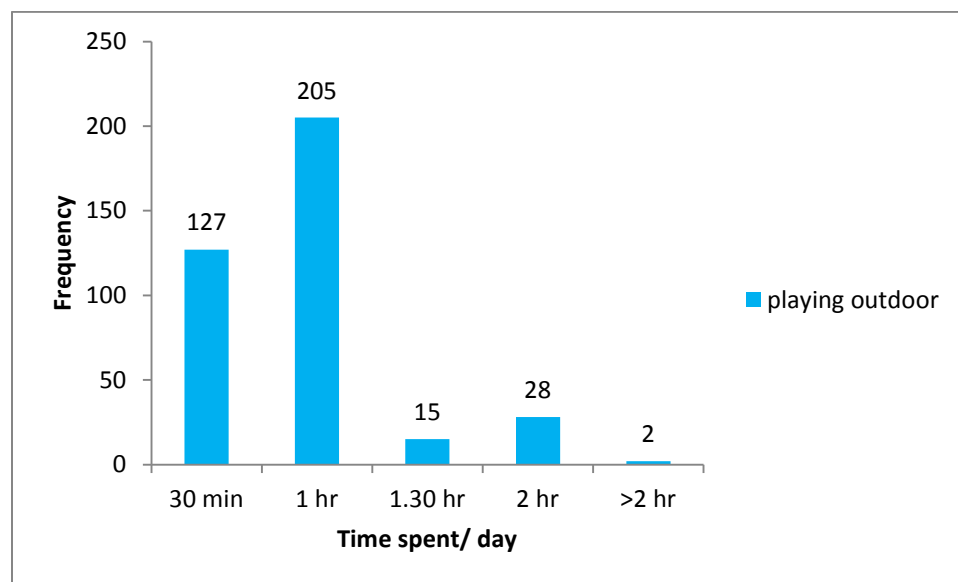
Figure 15: Distribution of time spent in playing outdoors (N=377)

6.3.9 Distribution of continuous reading time in study participants

Table 10 shows that among the study participants, 56.2% were reading continuously for less than 30 min and 43.8% were reading continuously for more than 30 min.

Table 10: Distribution of continuous reading time in study participants

Continuous reading time	Number of participants (N=422)	Percentage
< 30 min	237	56.2
>30 min	185	43.8
Total	422	100.0

6.3.10 Distribution of TV watching distance in study participants

In the study, 57% of the participants were watching television at a distance of less than 10 feet and 43% were watching at a distance more than 10 feet.
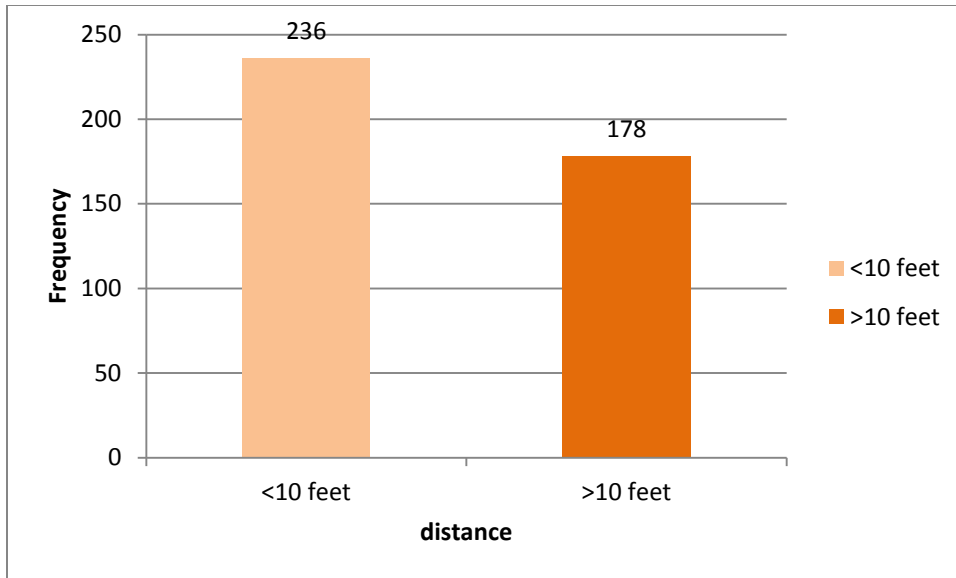
Figure 16: Distribution of TV watching distance (N=414)

6.3.11 Distribution of participants attending extra classes/tuition
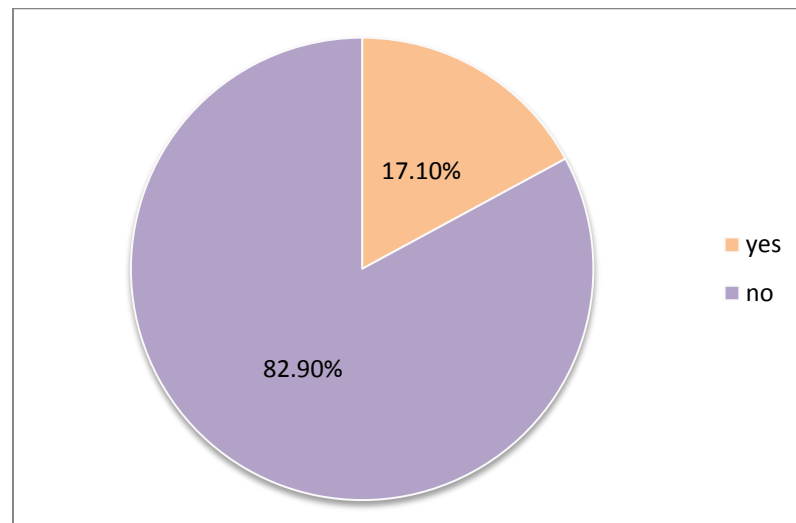
Figure 17: Distribution of participants attending tuition/extra classes

Figure 17 shows that among the study participants, only 17.1 % (72) were going to extra classes or tuition. 82.9% (350) were not attending any extra classes.

6.3.12 Distribution of reading posture among study participants

Among the study participants, 88.4% (N=373) were adopting sitting straight posture while reading and 11.6% (N=49) were using other postures like lying down and hunchback posture while reading.

Table 11: Distribution of reading posture among study participants

Reading posture	Number of participants (N=422)	Percentage
Sitting straight	373	88.4
Others	49	11.6
Total	**422**	**100**

6.3.13 Distribution of posture while watching TV

Table 12: Distribution of posture while watching TV

Posture	Frequency	Percentage
Sitting straight	265	64.0
Turns head to one side	39	9.4
lying	110	26.6
Total	**414**	**100.0**

About 9.4% of the participants turn head to one side while watching television.

6.3.14 Distribution of study place among study participants

Table 13 shows that among the study participants, 51.2 % were using hall as place for studying, 35.3% were using bedroom, 10.4% were using veranda and only 3.1% had separate study room.

Table 13: Distribution of study place among study participants

Place of study	Number of participants (N=422)	Percentage
Hall	216	51.2
Bedroom	149	35.3
Study room	13	3.1
Veranda	44	10.4
Total	**422**	**100.0**

6.3.15 Distribution of study participants reading at dim light
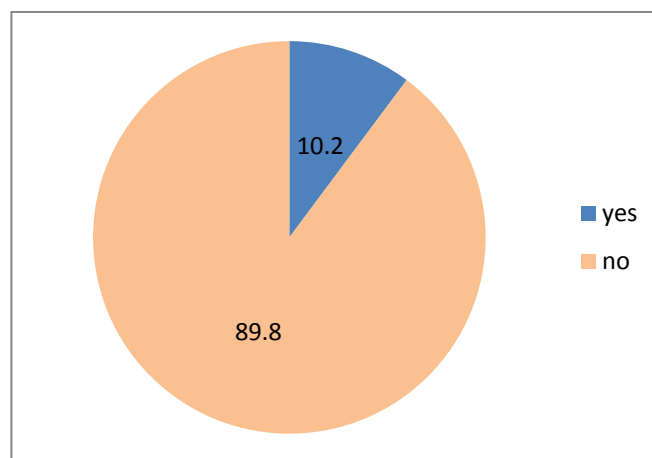
Figure 18: Distribution of study participants reading at dim light (N=422)

Among the study participants, only 10.2% were reading at dim light.

6.3.16 Distribution of BMI among study participants

Table 14: Distribution of BMI among study participants

BMI category	Frequency	Percentage
Underweight	159	37.7
Normal BMI	238	56.4
Overweight	18	4.3
obese	7	1.7
Total	422	100.0

In the current study 37.7% were underweight, 4.3% were overweight and only 1.7% were obese.

6.4 Association of refractive error with socio demographic variables

6.4.1 School wise distribution of refractive error

Among the study participants, private school students had 26.7% (N=56) prevalence of refractive error when compared to government school students who had only 14.2% (N=30). A statistically significant association was found between students in private school and prevalence of refractive error.
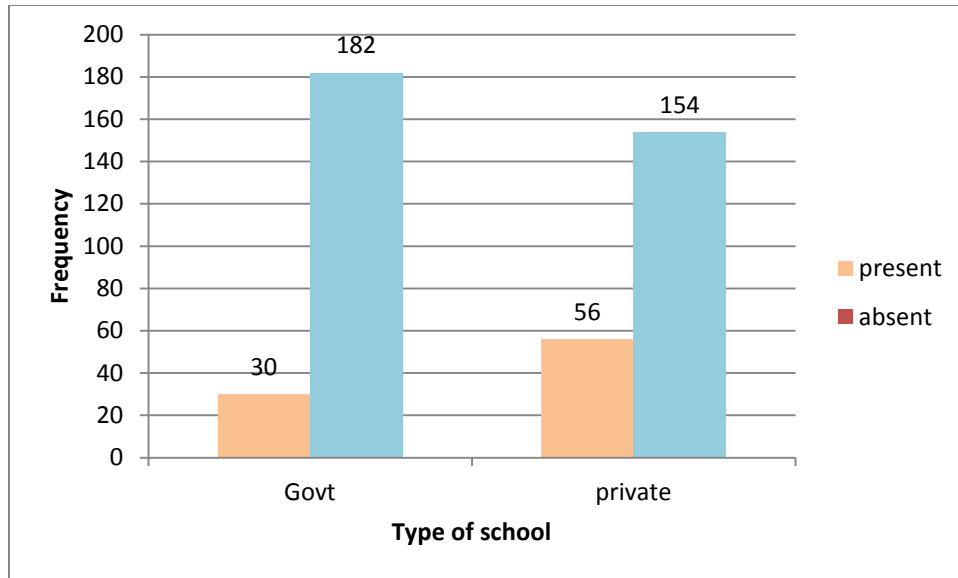
Figure 19: Distribution of refractive error among government and private schools

Chi square value= 10.185   df = 1   p value= 0.001 (S)

6.4.2 Age wise distribution of Prevalence of refractive error
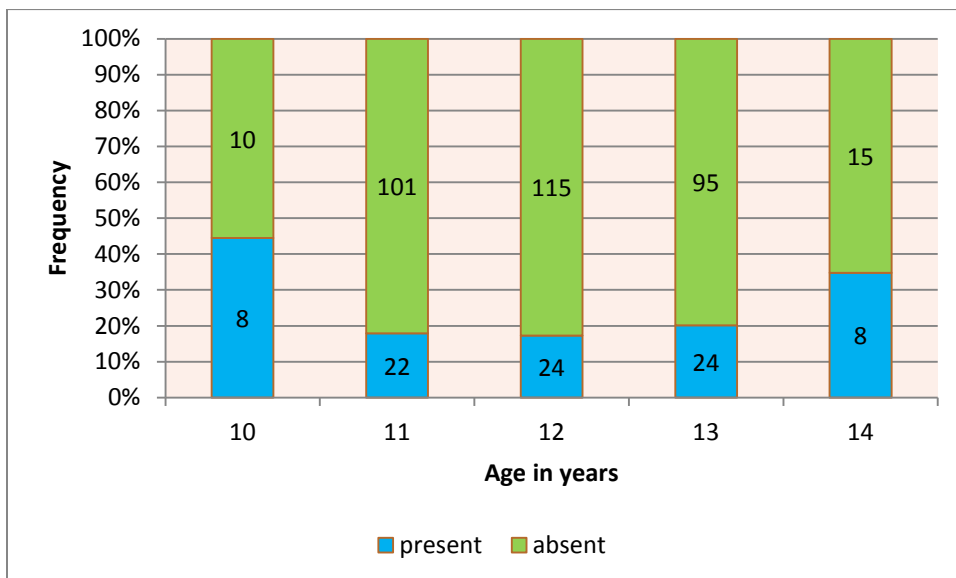
Figure 20: Age distribution of Refractive error

52

p value= 0.049 (S)   Fisher's Exact test

A statistically significant association was found between age and refractive error.

6.4.3 Gender distribution of refractive error

Figure 21 shows that among 238 male participants, 43 (18.1%) and among the 184 female participants, 43 (23.4%) had refractive error. The association between gender and refractive error was not statistically significant.
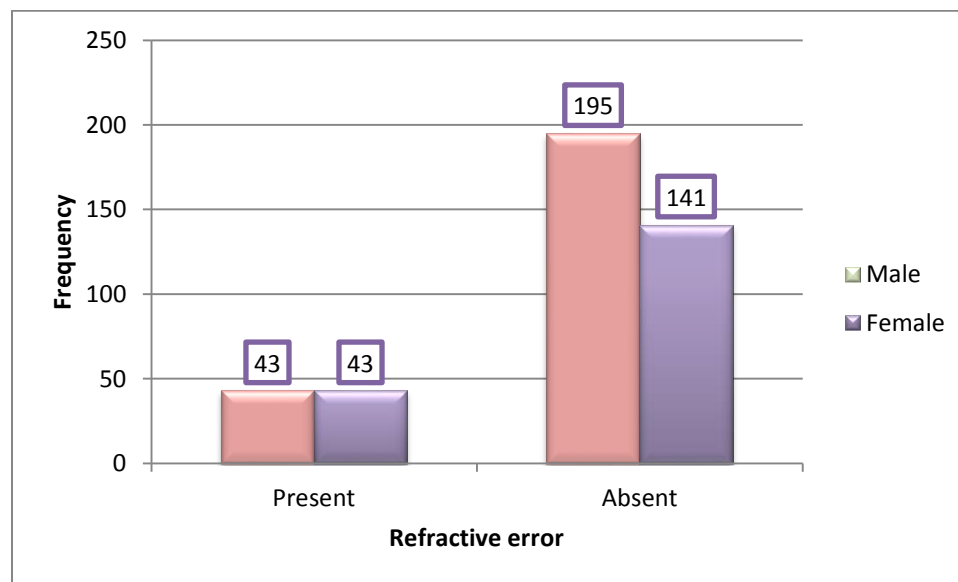
Figure 21: Gender distribution of refractive error

Chi square value= 1.798   df =1   p value= 0.180 (>0.05) NS

6.4.4 Religion wise distribution of refractive error

Among the Hindus, 329(20%) had refractive error, among Muslims, 2(28.6%) had refractive error and among the Christians, 2(50%) had refractive error and no statistically significant association was found.

Table 15: Cross tabulation between religion and refractive error

Religion	Refractive error		Total
	Present	**Absent**	
Hindu	82(20%)	329(80%)	411
Christian	2(50%)	2(50%)	4
Muslim	2(28.6%)	5(71.4%)	7
Total	**86(20.4%)**	**336(79.6%)**	**422**

Fisher's exact value= 2.903   df= 2   p value= 0.093(>0.05) NS

6.4.5 Socio economic class wise distribution of refractive error

Among the study participants, figure 21 shows that prevalence of refractive error increases as the socio economic class improves.

RE present
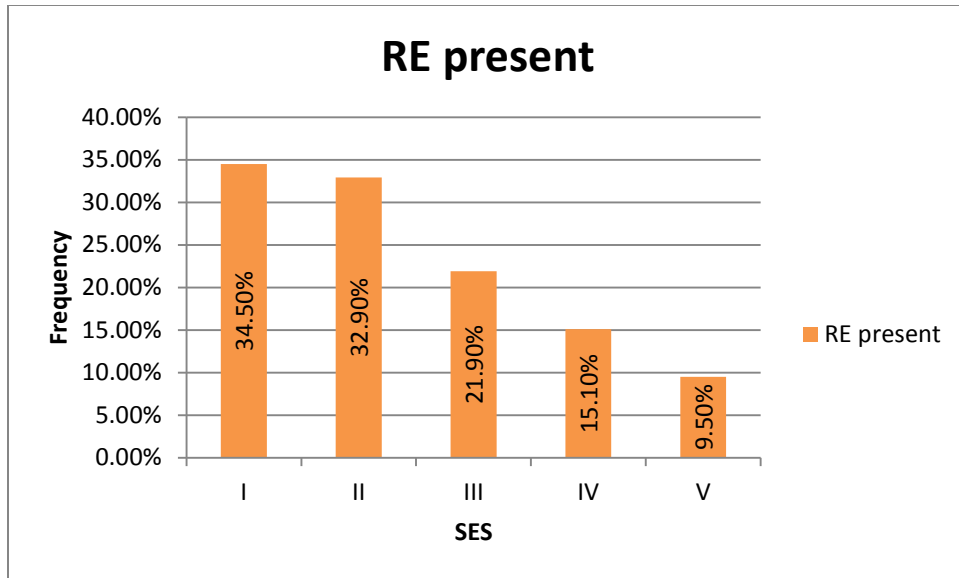
Figure 22: Socio economic class wise distribution of refractive error (N=422)

Chi square value= 17.887   **df= 4**   **p value= 0.001 (S)**

A statistically significant association was found between prevalence of refractive error and socio economic class.

6.4.6 Type of family and refractive error

It has been observed that prevalence of refractive error was higher in joint family. A statistically significant association was found between type of family and prevalence of refractive error.

Table 16: Cross tabulation between type of family and refractive error

Type of family	Refractive error		Total
	Present	**Absent**	
Nuclear family	56(19.2%)	236(80.8%)	292
Three generation	25(22.1%)	88(77.9%)	113
Joint family	5(29.4%)	12(70.6%)	17
Total	**86(20.4%)**	**336(79.6%)**	**422**

Fisher's exact value=1.556   df= 2   p value= 0.046   (S)

6.4.7 Education of parents and refractive error

Table 17: Cross tabulation between education of father and refractive error

Education of father	Refractive error		Total
	Present	**Absent**	
No formal education	3(33.3%)	6(66.7%)	9
Primary school	5(9.3%)	49(90.7%)	54
Middle school	13(17.8%)	60(82.2%)	73
Higher secondary	36(17.2%)	173(82.8%)	209
Graduate	28(38.4%)	45(61.6%)	73
Total	**85(20.3%)**	**333(79.7%)**	**418**

Fisher's exact test - p value= 0.001 (S)

It has been observed that as the level of literacy of father increases, the prevalence of refractive error is also increasing in their children. A statistically significant association was found between education of father and refractive error. It has been observed that a statistically significant association was found between education of mother and refractive error.

Table 18: Cross tabulation of education of mother and refractive error

Education of mother	Refractive error		Total
	Present	**Absent**	
No formal education	1(4.3%)	22(95.7%)	23
Primary school	8(16.3%)	41(83.7%)	49
Middle school	14(14.6%)	82(85.4%)	96
Higher secondary	39(20.9%)	148(79.1%)	187
Graduate	24(35.8%)	43(64.2%)	67
Total	**86(20.4%)**	**336(79.6%)**	**422**

Fisher's exact value=14.991   p value = <0.001 (S)

6.4.8 Occupation of parents and refractive error

Table 19 shows that a statistically significant association was found between occupation of father and refractive error.

Table 19: Cross tabulation between Occupation of father and refractive error

Occupation of father	Refractive error		Total
	Present	**Absent**	
Unskilled	39(15.4%)	215(84.6%)	254
Semi-skilled	17(24.6%)	52(75.4%)	69
Skilled	26(28.9%)	64(71.1%)	90
Semi professional	3(60%)	2(40%)	5
Total	**85(20.3%)**	**333(79.7%)**	**418**

Fisher's exact test= 13.041   p value<0.001(S)

Table 20: Cross tabulation between Occupation of mother and refractive error

Occupation of mother	Refractive error		Total
	Present	**Absent**	
Working mother	14(33.3%)	28(66.7%)	42
Home makers	72(18.9%)	308(81.1%)	380
Total	**86(20.4%)**	**336(79.6%)**	**422**

Chi square test=4.824   df= 1   p value= 0.028(S)

In this cross sectional study on prevalence of refractive error among school children, it has been observed that refractive error was higher among those children whose mothers were working. A statistically significant association was

found between working mothers and higher prevalence of refractive error in their children.

6.5 Association of refractive error with risk factors

6.5.1 Parental history and refractive error

In this cross sectional study on prevalence of refractive error, higher prevalence was observed if the history of refractive error is present in both the parent than having refractive error in single parent. Also the association of parental history with refractive error in children was found to be statistically significant.
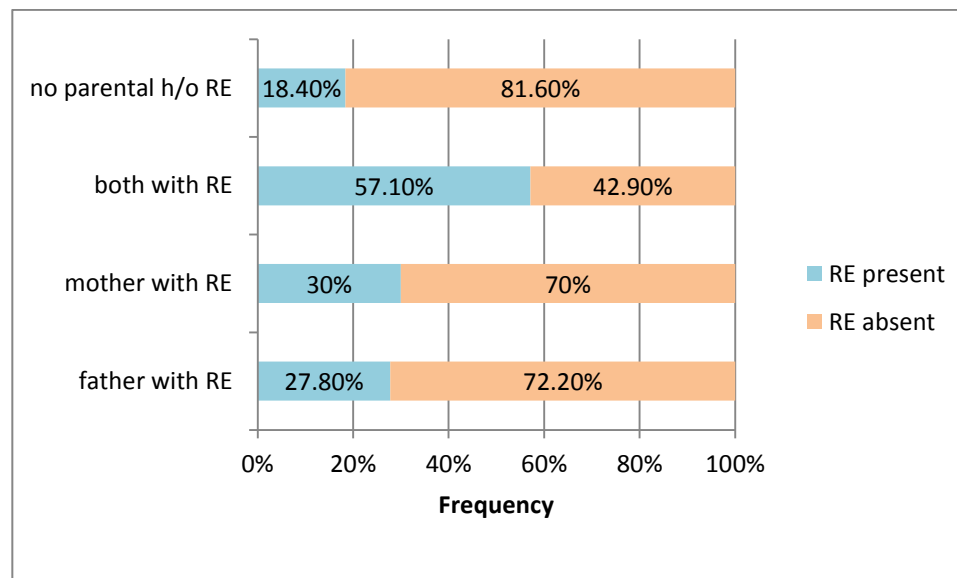
Figure 23: Parental history of RE and its prevalence in their child

Fisher's exact value=8.519   p value= 0.009 (S)

6.5.2 Sibling history of refractive error and refractive error in participants

Table 21 shows that prevalence of refractive error in participants with positive sibling history of refractive error. This association was not statistically significant.

Table 21: Sibling history of RE and refractive error in participants

Sibling history of refractive error	Refractive error		Total
	Present	**Absent**	
Yes	8(29.6%)	19(70.4%)	27
No	77(20.2%)	305(79.8%)	382
Total	**85(20.8%)**	**324(79.2%)**	**409**

Chi square value= 1.374   df =1   p value = 0.241 (>0.05) NS

6.5.3 School work and refractive error

Table 22: Cross tabulation between School work and refractive error

Time spent in doing School work	Refractive error		Total
	Present	**Absent**	
< 2hrs/day	50(18.8%)	216(81.2%)	266
= > 2 hrs/day	36(23.2%)	119(76.8%)	155
Total	**86(20.4%)**	**335(79.6%)**	**421**

Chi square value=1.182   df = 1   p value =0.277 (>0.05)   (NS)

Table 22 shows that prevalence of refractive error was higher among participants spending equal to or more than two hours per day in doing school work including both reading and writing. There is no statistical significance between time spent in doing school work and prevalence of refractive error.

6.5.5 Time spent in reading other books and refractive error

Table 23: Cross tabulation of Time spent in reading other books and refractive error

Reading other books	Refractive error		Total
	Present	**Absent**	
=< 1hr/ day	40(23.3%)	132(76.7%)	172
>1 hr/day	3(60%)	2(40%)	5
Total	**43(24.3%)**	**134(75.7%)**	**177**

p value= 0.80(fisher's exact test)

Table 23 shows that more than half of those who were reading books other than school books for more than 1 hr/day had refractive error. There is no statistically significant relationship between reading other books and refractive error.

6.5.6 TV watching duration and refractive error

Figure 23 shows that prevalence of refractive error increases as the duration of watching television increases. There is statistically significant association between time spent in watching television and prevalence of refractive error.
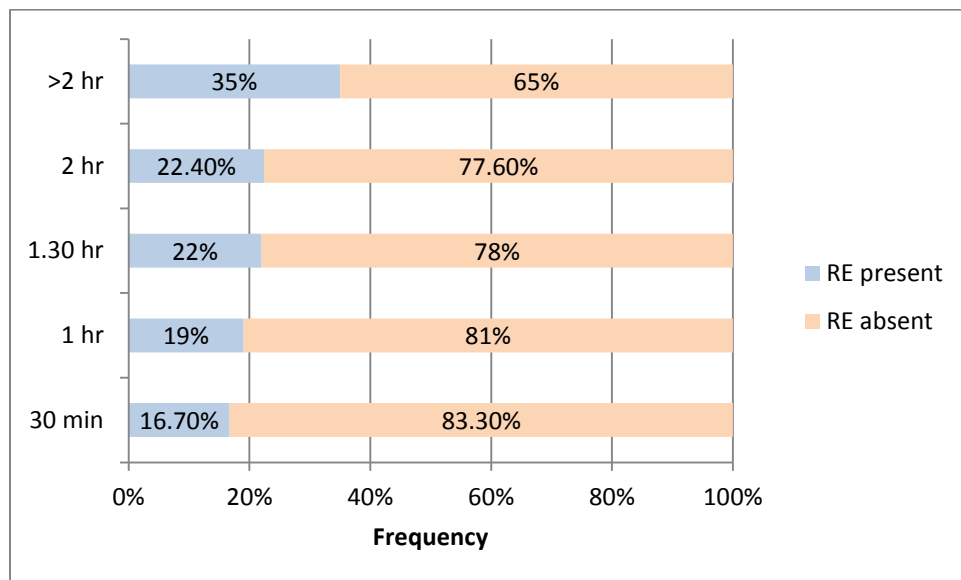
Figure 24: TV watching duration and refractive error

p=0.011 (Fisher's exact test)

6.5.7 Duration of Playing video/ mobile games and refractive error

In the analysis those who have no access to playing mobile/video games were excluded. No statistically significant association was found between playing video/mobile games and refractive error.

Table 24: Cross tabulation between Duration of Playing video/ mobile games and refractive error

Playing mobile / video games	RE		Total
	Present	**Absent**	
< 1hr/ day	39(20.4%)	152(79.6%)	191
>=1 hr/day	3(10.7%)	25(89.3%)	28
Total	**42(19.2%)**	**177(80.8%)**	**219**

Chi square test=1.484　　　df =1　　　　　　p value =0.223(NS)

6.5.8 Duration of computer/lap usage and refractive error

Table 25: Cross tabulation between computer/lap usage and refractive error

Computer/lap	Refractive error		Total
	Present	**Absent**	
< 1 hr /day	11(34.4%)	21(65.6%)	32
>1 hr/day	6(54.5%)	5(45.4%)	11
Total	**17(39.5%)**	**26(60.5%)**	**43**

P value= 0.142 (Fisher's exact test)　NS

In this cross sectional study on prevalence of refractive error, cross tabulation shows that more than half of those using computer or lap for more than 1 hr/ day had refractive error. This association between refractive error and using computer or lap is not statistically significant. Those who did not have access to computer/ lap were excluded for analysis.

6.5.9 Playing outdoors and refractive error

In this cross tabulation analysis, refractive error prevalence is inversely related to duration of playing outdoors. This association between playing outdoors and prevalence of refractive error is not statistically significant.

Table 26: Cross tabulation between playing outdoors and refractive error

Playing outdoors	Refractive error		Total
	Present	**Absent**	
<2 hr/day	71(20.5%)	276(79.5%)	347
> = 2 hr/day	4(13.3%)	26(86.7%)	30
Total	**75(19.9%)**	**302(80.1%)**	**377**

Chi square test=0.880   df=1   p value=0.348(NS)

6.5.10 Continuous reading time and refractive error

The association between continuous reading time for more than thirty minutes and prevalence of refractive error is not statistically significant.

Table 27: Cross tabulation between Continuous reading time and refractive error

Continuous reading time	Refractive error		Total
	Present	**Absent**	
<30 min	46(19.4%)	191(80.6%)	237
> 30 min	40(21.6%)	145(78.4%)	185
Total	**86(20.4%)**	**336(79.6%)**	**422**

Chi square test =0.313   df =1   p value= 0.576(NS)

6.5.11 TV watching distance and refractive error

Table 28: Cross tabulation between TV watching distance and refractive error

TV watching distance	Refractive error		Total
	Present	**Absent**	
< 10 feet	52(22%)	184(78%)	236
> 10 feet	32(18%)	146(82%)	178
Total	84(20.3%)	330(79.7%)	414

Chi square test= 1.032   df= 1   p value=0.310(NS)

Table 28 shows that there is no statistically significant association between distance of watching television and prevalence of refractive error.

6.5.12 Extra classes/Tuition and refractive error

There is no statistically significant association between attending extra classes or tuition and prevalence of refractive error.

Table 29: Cross tabulation between Extra classes/Tuition and refractive error

Extra classes/Tuition	Refractive error		Total
	Present	**Absent**	
Yes	16(22.2%)	56(77.8%)	72
No	70(20%)	280(80%)	350
Total	86(20.4%)	336(79.6%)	422

Chi square test= 0.182   df=1   p value= 0.670 (NS)

6.5.13 Reading posture and Refractive error

Table 30: Cross tabulation between Reading posture and Refractive error

Reading posture	Refractive error		Total
	Present	**Absent**	
Sitting straight	70(18.8%)	303(81.2%)	373
Other	16(32.7%)	33(67.3%)	49
Total	**86(20.4%)**	**336(79.6%)**	**422**

Chi square test=5.147   df= 1   p value=0.023(S)

66

Table 30 shows that there is statistically significant association between this inverse relation of reading in sitting straight posture and risk of refractive error.

6.5.14 BMI category and refractive error

Table 31: Cross tabulation between BMI category and refractive error

BMI category	Refractive error		Total
	Present	**Absent**	
Underweight	27(17.0%)	132(83.0%)	159
Normal BMI	51(21.4%)	187(78.6%)	238
Overweight	4(22.2%)	14()77.8%	18
Obese	4(57.1%)	3(42.9%)	7
Total	**86(20.4%)**	**336(79.6%)**	**422**

p=0.009 (S) Fisher's exact test

Table 31 shows that a statistically significant relation was found between BMI and refractive error.

6.5.15 Factors associated with refractive error by multivariate analysis:

Binary logistic regression analysis showed that the difference in the prevalence of refractive error and its associated factors type of school, age, education of parents, occupation of parents, type of family, duration of

watching television, socio economic class, reading posture and BMI was not

significant .

Table 32: Logistic regression analysis of the factors associated with RE

Variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Age	-.132	.133	.987	1	.320	.876	.675	1.137
Education of Father	-.081	.180	.203	1	.653	.922	.649	1.311
Education of Mother	-.221	.173	1.633	1	.201	.801	.571	1.125
Occupation of Father	-.203	.172	1.388	1	.239	.816	.582	1.144
Occupation of Mother	.168	.419	.160	1	.689	1.183	.520	2.691
Parental History of Refractive Error	.065	.136	.227	1	.634	1.067	.818	1.391
Type of family	-.151	.227	.439	1	.508	.860	.551	1.343
Watching Tv	-.167	.116	2.069	1	.150	.846	.674	1.062
SES	.279	.166	2.831	1	.092	1.321	.955	1.828
Reading posture	-.677	.366	3.424	1	.064	.508	.248	1.041
BMI	-.194	.207	.876	1	.349	.824	.549	1.236
Constant	4.553	2.389	3.634	1	.057	94.950		

a. Variable(s) entered on step 1: school, age, father_edu, mother_edu, occu_father, occu_mother, parental_ho, typeoffamily, watching_tv, ses_cat, readpostu_cat, bmi_cat.

6.5.16 Factors associated with usage of spectacles

a. Gender and spectacle usage

Table 33: Cross tabulation between Gender and spectacle usage

Gender	Spectacles		Total
	Yes	No	
Male	9(20.9%)	34(79.1%)	43
Female	7(16.3%)	36(83.7%)	43
Total	16(18.6%)	70(81.4%)	86

Chi square test=0.307   df= 1   P=0.579(NS)

There was no statistically significant association between gender and usage of spectacles among the study participants.

b. Education of parents and spectacle usage

A statistically significant association was found between education of father and spectacle usage among the participants with p value = 0.020(Fisher's exact test).
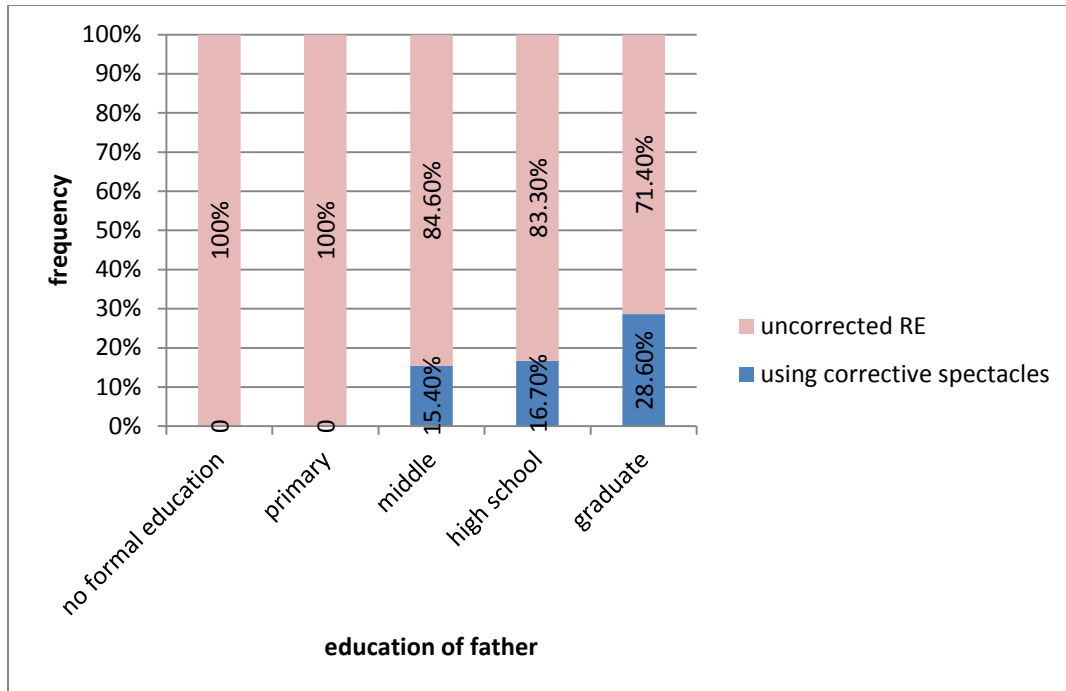
Figure 25: Education of father and spectacle usage

Similarly mother's education status was also statistically significant (p=0.049 Fisher's exact test) with spectacle usage.

c. Type of school and spectacle usage

Table 34 shows that 20% student in government schools and 17.9% student in private schools were already diagnosed with refractive error and a corrective spectacle was given.

Table 34: Type of school and spectacle usage

Type of school	Spectacle usage		Total
	yes	**No(Uncorrected RE)**	
Govt school	6(20.0%)	24(80.0%)	30
Private school	10(17.9%)	46(82.1%)	56
Total	**16(18.6%)**	**70(81.4%)**	**86**

Discussion

7. DISCUSSION

The current study is a school based cross sectional study conducted to estimate the prevalence of refractive error and the distribution of its various associated factors among school children. This study carries significance as there is large iceberg of uncorrected refractive errors in the school children which can be easily corrected. Refractive errors can be easily detected and treated in the primary health care level itself.

The number of study participants involved was 422 students. Among the study participants, 56.4% (238) were males and 43.6% (184) were females. The age of the study participants ranged from 10 to 14 years. Majority of the study participants were Hindus (97.4%). Among the study participants, only 4% belonged to joint family. Majority of the participants were from nuclear family (69.2%) and 26.8% belonged to three generation type of family. Socio economic status of the participants was classified based on modified B.G Prasad's Classification 2015. Based on the classification, a large proportion of participants belonged to class IV status (36%).

7.1 Prevalence of refractive error

Refractive errors can lead to severe visual impairment if left untreated. 80% of all visual impairment can be prevented or cured by early diagnosis and treatment.

In the present study, among the four schools visited, 86 school children (20.4%) had at least one type of refractive error with myopia of 19.7% and hypermetropia of 0.7%. This was similar to the findings of by Suba Joice et al study in Puduchery which reported prevalence of 20.9%. [36]

The overall prevalence of refractive error varies from 5.6% in Kamath et al study [27], 6.43% in study done by Niroula et al[23], 6.94% in Singh et al [28],7.57% Roopa naik et al[30], 11.9% prevalence in cross sectional study done by Shrestha et al[18], 13.09% in study done by Singh et al in 2013[26], 22% in Gupta et al[33] and in the study done by Sonam Sethi et al prevalence was 25.32%[10].

The difference in prevalence estimates between these studies and the present study could be due to various reasons like;

1. The differing survey methods, particularly the definitions of refractive errors, are a serious problem, preventing the valid comparison of such studies. It seems possible that variations in the sample size are of great importance.

2. Varied age groups recruited by different studies.

3. Rural-urban differences and the type of schools also play a major role because of the different rates of exposure to the risk factors.

The most common refractive error in the study population was myopia 19.7% and only 0.7% of hypermetropia was observed. In a survey conducted by Lin LL et al in Taiwan to study the prevalence among school children, the rate of myopia increased from 20% at 7 years, to 61% at 12 years, and 81% at 15 years[19].

Mutti et observed that among the eighth grade children, the prevalence of myopia was 18.3% and hyperopia was 7.7% [22]. In Niroula et al study, prevalence of myopia was 4.05%, hyperopia (1.24%) and astigmatism (1.14%).[23]

Prevalence of myopia was 33 % in cross sectional study done by Chu et al in Taiwan school children which was higher than the present study[24].

In a meta-analysis done by Castagno et al prevalence of hyperopia was 2-3% between age 9 and 14. In studies using the 5-15 age group and $\geq +2.00$ D (RESC) cut-off, hyperopia prevalence ranged from 2.1% to 19.3% .[25]

7.2 Refractive error and socio demographic variables

7.2.1Age and refractive error

In the current study, prevalence of refractive error at the age of 11, 12, 13and 14 years with years were 17.9%, 17.3%, 20.2% and 34.8% respectively. A statistically significant association was found between age and prevalence of refractive error. Children in the age of 10 yr had higher prevalence than others; this could be possible due to earlier age of starting to study. This finding was consistent with study by Sun et al in which increase in age was associated with increased risk of having myopia [21]. Also in Saw et al study on near work and early onset myopia in Singapore observed that prevalence rate of myopia increased with age[38]. In a study by Sonam Sethi et al refractive error increased with age with only 1.4% prevalence at 5 years of age, increasing to 13.8% at 10 years, 18.4% at 11 years, 23.5% at 12 years, 17.7% at 13 years and again

decreased to 5.1% at 14 yrs[10].Kamath et al in Karnataka observed similar finding and was significant statistically (χ^2=95.85, p<0.001)[39].

7.2.2 Gender and refractive error

In the present study the prevalence of refractive error was higher in girls than in boys. But the association between gender and refractive error in this current study was not statistically significant p value= 0.180. In surveys done by Singh et al in Bhopal[26], Lin LL et al in Taiwan [19]and Nitin Batra et al [40],Chu et al [24], girls had a significantly higher odds ratio compared with boys. This gender difference was inconsistent with school based survey done by Chandramohan et al in which refractive error was more among male children (21.5%) than the female children (17%).[37]

Yi Sun et al in China observed that boys had more myopic refractive error than girls, and this difference was significant (p=0.0397)[21]. Also observed in Niroula et al study in Nepal[23], Sonam Sethi et al study in Ahmedabad [10]and Amol Bansal et al study in Karnataka[29].

7.2.3 Socio economic class and refractive error

As the socio economic class improves, higher the prevalence rate of refractive error was the observation made in this study. Class V participants had higher prevalence of 90.5%. A statistically significant association was found between prevalence of refractive error and socio economic class with Chi square value= 17.887 and p value= 0.001 (S). Factors like increased near work activities,

watching TV, playing video games and decreased outdoor activity could probably make the higher socio economic class students more vulnerable to refractive error.

Similar finding of significant association was found between higher prevalence rates and socio economic status p=0.001 in Saw et al study on near work and early onset myopia in Singapore[38].

A significant decreasing prevalence of ocular diseases as one climbs up the socio economic ladder (p<0.001) was observed in a study by Deshpande Jayanth et al and is said to be due to improved nutrition and hygiene[32]. This can be due to inclusion of other ocular diseases in children like vitamin A deficiency and conjunctivitis, etc.

7.2.4 Type of family and refractive error

It has been observed that prevalence of refractive error was higher in joint family in this study. A statistically significant association was found between type of family and prevalence of refractive error with p value= 0.046 (S).Saw et al observed similar finding of significant association between large family type and higher myopia prevalence rates, (p =0.001)[38]. In contrary family type ($\chi2$=2.41, p=0.121) is not associated with ocular morbidity in study by Deshpanse et al[32]. This could be probably that in joint family at any time someone will be watching television and children were getting more chances to watch TV.

7.2.5 Education of parents and refractive error

A statistically significant association was found between both education of father, p value= 0.001 and education of mother with p value of <0.001 and the higher prevalence of refractive error in their children. This finding was similar with the study by Deshpande Jayanth et al[32]. In a study done by Dandona et al in 2002, myopia was associated with increasing levels of education of the father [34]. In a school based study in Singapore by Louis tong et al, father's education level was not significantly related (p > 0.05)[20].

Saw et al also observed similar finding of significant association between higher prevalence of RE and higher the father's and mother's education [38]. This could be probably due to increased pressure by parents to spend more time in academic activities.

7.2.6 Occupation of parents

In this cross sectional study on prevalence of refractive error among school children, it has been observed that a statistically significant association was found between occupation of father and refractive error p<0.001. And also a statistically significant association was found between working mothers and higher prevalence of refractive error in their children. p value= 0.028(S). This finding was similar with the study by Deshpande Jayanth et al[32]. This could probably be due to children of working mothers spend more time in watching television when the mother goes for work.

7.3 Refractive error and risk factors:

Significant association was seen with socio economic status, education and occupation of parents, type of schooling, parental history of refractive error and time spent in watching television.

7.3.1 Type of school and refractive error

A statistically significant association was found between students in private school and higher prevalence of refractive error 26.7%. **(Chi square value= 10.185 and p value= 0.001).** This was similar to the findings of study by Niroula et al in which the prevalence of refractive errors were higher in private (9.29%) than Government school children (4.23%) which was statistically significant (p < 0.05)[23].Kamath et al also observed that refractive error was the commonest problem among the private school going children (6.5%) [39]. It could be probably due to the following reasons; children in private schools have high SES and also they spend more time in doing home work, watching television and high access to computer as compared to government school children. These near activities could cause stress on eyes of the children and might be one of the causes of developing refractive error. Contrary to this a study by Shrestha et al observed no significant difference in the prevalence of refractive status in the students from government and private schools[18].Amol Bansal et al study in Karnataka observed that the prevalence of refractive error in government schools was 12.1% and in private schools it was 11.8%[29].

7.3.2 Parental history of refractive error

In this present study it has been observed that significant association was found between refractive error in children and parental history of RE with p value of 0.009. If one or both the parents had refractive error, prevalence was higher in their children. Similar to this was found in a study done by Prema in Tamilnadu in which significant association was present with p value <0.001[35]. Yi sun et al in China observed that prevalence was more in children who had parental history of myopia , p=0.002[21]. Mutti et al study also observed similar findings[22].Saw et al in their study found statistically significant relation between refractive error and parental myopia with p value <0.001[38]. In the SMS study, risk was higher in children with one and two myopic parents [41].

Richard et al study in Singapore also showed that children having one or two parents with myopic history increased the chance of myopia by 0.39 and 0.74 D, respectively[42].Kurtz D et al reported that the myopic parents was directly proportional and in many ways associated with near vision progression among children[43].

7.3.3 Near work and refractive error

In this study there is no statistically significant association between time spent in doing school work, reading for pleasure, playing video games, computer usage and risk of refractive error in the participants. Time spent in watching TV per day is directly related to prevalence of refractive error and is statistically significant p=0.011.

Yi sun et al observed that both myopes and non-myopes had no difference in relation with their hours spent studying, watching television and working or playing on a computer [21]. In a study by Mutti et al showed that those children suffering with defective near vision had less time engaged in sports and more associated with near activities, compared with emmetropes. Spending more time on television and playing video games or working on the computer did not make much between myopes and emmetropes[22]. Saw et al in Singapore reported that children who read more than 2 hours per day the O.R. of higher myopia was 2.16 (95% CI, 1.34–3.47), and the multivariate adjusted O.R. was 1.50 (95% CI, 0.87–2.55). Similarly, children who regularly used the system had doubled their chances to get increased rate of higher myopia[38]. In a study by Prema et al, greater association was found between refractive error and near work with Chi square value of 35.57and p value<0.001. Children who worked more than two hours with computer systems and watching TV a lot are affected by refractive error than the children who used both for less than two hours[35].

7.3.4 Tuition

In this present study, there is no significant relation between children attending tuition and refractive error. This is in in contrary with Saw et al study on near work and early onset myopia in Singapore which reported that children taking extra tuition classes were doubled themselves the chances likely to have higher myopia[38].

7.3.5 Continuous reading time

There was no significant relation between continuous reading time and refractive error in the present study. Contrary with this is study on effect of close or near work in myopia in Australia done by Ip et al observed that 12 year old children who had reading habits continuously for more than 30 min were more likely to develop myopia compared to those who read for less than 30 min continuously[44]. This could be due to variation in sampling population and place of study.

7.3.6 Outdoor activities

Refractive error prevalence is inversely related to playing outdoors. This association between playing outdoors and prevalence of refractive error is not statistically significant in this study. In contrary to this study, Rose et al in Australia reported that children who spent low outdoor time and more indoor activities were twice to thrice more likely to be myopic compared to those performing low near work and high outdoor activities[45]. In Singapore, a study with cross-sectional design was conducted to analyze the effect of outdoor activities on myopia by Dirani M et al and the result showed that the total outdoor activity (h/day) was significantly associated with myopia[46].

Prema in her study on causative factors for refractive error observed that refractive error and outdoor activities were inversely proportional with Chi square value of 10.89 and p value= 0.001[35].

7.3.7 Nutritional status and refractive error

A statistically significant association was found between increase in BMI and prevalence of refractive error in this study p=0.009. This finding is similar to study done by Chu et al in Taiwan school children, in which univariate analysis shows myopia was statistically significant with BMI [24]. Sawet al observed that in Singapore Chinese children with increased body weight had refractions that were more hyperopic, after analyses controlling for other factors like age, gender, parental myopia, reading, and school[47].

Apart from these factors inverse relation between reading in sitting posture and refractive error was statistically significant p=0.023 in this present study and other factors like TV watching distance, dim light reading and position of light while reading were not significantly related to refractive error.

7.4 Spectacle usage among study participants

Among the study participants, 20.4% (N=86) children were identified as having refractive error. But only 18.6% (N=16) of those with refractive error were already diagnosed and using corrective spectacles for refractive error, remaining (81.4%) were not aware of their problem.This is lower than the study by Deshpande Jayanth et al in Maharashtra, 42.85% of children were using corrective spectacles[32]. Only one fourth were using refractive correction in study by Bansal et al[29].

Among those using corrective spectacles in the current study (N=16), 81.3% (n=13) were using it regularly. The reasons for irregular usage of corrective spectacles observed among the study participants were getting teased by others and spectacles getting dirty.

Summary and Conclusion

8. SUMMARY AND CONCLUSION

A school based cross sectional study was done to find out the prevalence of refractive error and its risk factors among 422 participants in selected schools of Krishnagiri. A semi structured pretested questionnaire was used to collect information regarding the socio-demographic details, risk factor exposure and spectacle usage among the participants. Screening of eye was done to detect the refractive status of the children which can be easily corrected by spectacles.

The study revealed the following findings:

- The prevalence of refractive error among the study population was 20.4% (86 participants) and among them the most common error was myopia with 96.51% (83 participants).

- Among the 86 participants with refractive error, 61 (70.9%) had complaints related to refractive error. The most common symptom was blurred vision (26.7%) followed by double vision (15.1%) and headache (11.6%).

- Only 18.6% (N=16) of those with refractive error were already diagnosed and using corrective spectacles for refractive error, remaining (81.4%) were not aware of their problem.

- Private school students had 26.7% (N=56) prevalence of refractive error when compared to government school students who had only 14.2% (N=30) and was statistically significant.

- Prevalence of refractive error was significantly higher with increasing age, in joint family and higher educational status of their parents and also occupation of the parents.

- Prevalence of refractive error showed significantly direct relationship with the socio economic status of the population

- A statistically significant association was found between prevalence of refractive error and positive parental history of refractive error, watching television for more than two hours, reading in sitting posture and with higher BMI grade among the study participants.

- A statistically significant association was found between higher usage of spectacles among those with refractive error and education of their parents

The study therefore highlights the high prevalence of undetected refractive error in the school children and the importance of early detection and treatment with corrective spectacles which halts the further progression of refractive error.

Limitations

9. LIMITATIONS

1. The present study was done among school going children only, hence limits the generalizability of findings. A large section of children in rural India are drop-outs and do not attend schools; hence assessing visual impairment in children becomes possible only with population based studies not restricting only to school going children.

2. In this present study only refractive status of the school children were assessed and other ocular morbidities in school children like Vitamin A deficiency, conjunctivitis and other causes were not included in the study.

3. Data on near work activities may not be giving real picture as it was collected from the parents who aspire to make their children to achieve academically.

4. It is also understood that near work and outdoor activities vary between weekdays and weekends.

5. The study carries the inherent limitations of cross sectional studies, thereby disabling the understanding of true temporal relationships between the risk factors and refractive error.

Recommendations

10. RECOMMENDATIONS

Based on the findings of the current study, the following recommendations are being put forward.

1. Provision of corrective spectacles to school children should be made available in the underserved areas.

2. School teachers should be made aware and they should play an active role in identifying the ocular problems and referring them for timely management.

3. At community level, school health programmes should be effectively implemented and accompanied by education and awareness campaigns to ensure that the corrections are used.

4. Parents should insist their child to shorten the duration of using computers and other near work activities Also children should have as many outdoor activities as possible. Health and hygienic habits to be inculcated in children to maintain good vision.

5. Increase parental awareness of symptoms in a child suggestive of poor vision.

6. Children with history of refractive error in family should be screened at an early age.

7. In the future more accurate and more standardized methodology for quantifying near work needs to be used, which should facilitate precise comparison between different studies.

8. Community based studies should be done to cover school drop-outs and also barriers of refractive correction like lack of awareness and early correction, cultural disincentives to compliance could be addressed.

   The present study being a cross sectional study is not able to assure causality association for the refractive error morbidity. Hence a prospective study on large scale may be undertaken to prove causal association.

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Annexures

ANNEXURE-1

INFORMATION SHEET

Title of the study:

"A study on prevalence of Refractive error and its associated factors among school children in Krishnagiri district, Tamil Nadu – 2015."

Uncorrected refractive error is the leading cause of eye problem worldwide and the second cause of blindness. Children are more vulnerable group, because uncorrected refractive error can result in to a dramatic impact on learning process and educational capacity. Most of the children with such diseases are apparent and hence screening helps in early detections and correction. Major causes of childhood blindness are easy to detect and approximately 40% are preventable.This study is an attempt to estimate the prevalence of refractive error among school children.

We request you to participate in this study.

The privacy of the participants will be maintained throughout the study. In the event of any publication or presentation resulting from the study, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study. Your decision will not result in any loss of benefits to which you are otherwise entitled.

The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment or prevention.

ஆராய்ச்சி தகவல் தாள்

கிருஷ்ணகிரியில் உள்ள பள்ளிக்குழந்தைகளிடம் கதிர்சிதைவு பிழை பாதிப்பு மற்றும் அதன் தொடர்புடைய காரணிகள் பற்றிய ஆய்வு.

உலகலவில், திருத்தபடாத கதிர்சிதைவு பிழையானது கண் பிரச்சனை மற்றும் குருட்டுத்தன்மை ஆகியவற்றிற்கு முக்கிய காரணமாக விளங்குகின்றது. குழந்தைகளில் திருத்தப்படாத கதிர்சிதைவு பிழை செயல்முறை மற்றும் கல்வித்திறன் கற்றல் ஆகிய வற்றின் மீது ஒரு வியத்தகு தாக்கத்தை ஏற்படுத்தும். இது போன்ற கண் பிரச்சனைகள் குழந்தைகளுக்கு மிக வெளிப்படையாக இருக்கும். ஆகவே தொடக்க நிலையிலே கண் பரிசோதனை செய்வதன் மூலம் நோய் கண்டறிதலும் திருத்தமும் எளிதாகின்றன. இந்த ஆய்வு கதிர்சிதைவு பிழை பாதிப்பை பள்ளிக் குழந்தைகளில் கண்டறிய உதவும்.

நீங்கள் இந்த ஆய்வில் பங்கேற்க நாங்கள் விரும்பிகிறோம்.

இந்த ஆய்வின் முடிவுகளை அல்லது கருத்துகளை வெளியிடும் போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது மகன் / மகளின் பெயரையோ அல்லது அடையாளங்களையோ வெளியிட மாட்டோம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

இந்த ஆய்வில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது.

இந்த சிறப்புப் பரிசோதனைகளின் முடிவுகளை ஆய்வின் போது அல்லது முடிவின் போது தங்களுக்கு அறிவிப்போம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

ஆராய்ச்சியாளர் கையொப்பம்   பெற்றோர் கையொப்பம்

தேதி:

ANNEXURE 2
INFORMED CONSENT FORM

Title of the study:

"**A study on prevalence of refractive error and its associated factors among school children in Krishnagiri district, Tamil Nadu – 2015**"

Name of the participant: **Age/Sex:**
S.no:

(1) I have been explained in detail about the study and its procedure. I confirm that I had completely understood the study and have had the opportunity to ask questions

(2)   I understand that my son/daughter's participation in the study is voluntary and that my son/daughter is free to withdraw at any time, without giving any reason, without their medical care or legal rights being affected.

(3) I understand that the principal investigator, others working on the investigator's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at health records both in respect of the current study and any further research that may be conducted in relation to it, I agree to this access. However I understand that my son/daughter's identity will not be revealed in any information released to third parties or published.

(4) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).

(5) I agree to my son/daughter participating in the above study.

Signature of investigator   Signature of the parent

Date:

ஆராய்ச்சி ஒப்புதல் கடிதம்

கிருஷ்ணகிரியில் உள்ள பள்ளிக்குழந்தைகளிடம் கதிர்சிதைவு பிழை பாதிப்பு மற்றும் அதன் தொடர்புடைய காரணிகள் பற்றிய ஆய்வு.

பெயர்:   வயது:   பால்:

ஆராய்ச்சி சேர்க்கை எண்:   தேதி:

இந்த ஆராய்ச்சியின் விவரங்களும் அதன் நோக்கங்களும் முழுமையாக எனக்கு தெளிவாக விளக்கப்பட்டது.

எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்து கொண்டு நான் எனது சம்மதத்தை தெரிவிக்கிறேன்.

இந்த ஆராய்ச்சியில் பிறரின் நிர்ப்பந்தமின்றி என் விருப்பத்தின் பேரில் தான் என் மகன்/மகள் பங்கேற்க விரும்புகிறேன் மற்றும் என் மகன் / மகள் இந்த ஆராய்ச்சியிலிருந்து   எந்நேரமும் பின்வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் புரிந்து கொண்டேன்,

இந்த ஆராய்ச்சியின் விவரங்களைக் கொண்ட தகவல் தாளைப் பெற்றுக்கொண்டேன். நான் என்னுடைய சுயநினைவுடன் மற்றும் முழு சுதந்திரத்துடன் இந்த மருத்துவ ஆராய்ச்சியில் என் மகன் / மகள் சேர்த்துக்கொள்ள சம்மதிக்கிறேன்.

ஆராய்ச்சியாளர் மற்றும் அவரைச் சார்ந்தவர்களோ நெறிமுறைக்குழு உறுப்பினர்களோ நான் இந்த ஆராய்ச்சியிலிருந்து விலகினாலும் என்னுடைய அனுமதியின்றி எனது   மகன்/ மகள் உடல்நிலை குறித்த தகவல்களை இந்த ஆராய்ச்சிக்கோ இது தொடர்பான வேறு ஆராய்ச்சிக்கோ பயன்படுத்திக் கொள்ள முடியும் என்று புரிந்துக் கொண்டு சம்மதம் அளிக்கிறேன். ஆனாலும் எனது மகன்/ மகளின் அடையாளம் வெளியிடப்பட மாட்டாது என்பதை புரிந்து கொள்கிறேன்.

இந்த ஆராய்ச்சியின் தகவல்களையும் முடிவுகளையும், அறிவியல் நோக்கத்திற்காக பயன்படுத்துவதற்கு நான் அனுமதிக்கிறேன். இந்த ஆராய்ச்சியில் என் மகன்/மகள் பங்குபெற நான் சம்மதிக்கிறேன்.

ஆராய்ச்சியாளர் கையொப்பம்   பெற்றோர் கையொப்பம்

தேதி:

ANNEXURE 3

Questionnaire

"A study on prevalence of Refractive error and its associated factors among school children in Krishnagiri district, Tamil Nadu – 2015."

S.No. _____   **School Name:**
_____

Type of school: ☐ Govt   ☐ private

1. Name   :   _____

2. Age   :   _____

3. Gender   :   ☐ Male   ☐ Female

4. Class   :   _____

5. Address   :   _____

6. Is the Child wearing corrective spectacles :   ☐ yes   ☐ no

    a. If yes, using spectacles regularly   :   ☐ yes   ☐ no

    b. Reason for irregular use- 1. Wearing glasses bothers one
                                   2. Glasses getting dirty
                                   3. Glasses getting fogged up or wet;
                                   4. Losing/looking for glasses
                                   5. Teased by others
                                   6. Others-

7. Symptoms related to refractive error

        Double vision   :   ☐ yes   ☐ no

        Blurred vision   :   ☐ yes   ☐ no

        Pain in eye   :   ☐ yes   ☐ no

        Irritation of eyes :   ☐ yes   ☐ no

Redness in eyes by evening   :   ☐ yes   ☐ no

Watering in eyes by evening: ☐ yes   ☐ no

Headache by evening   :   ☐ yes   ☐ no

8. Place of studying in home? _____

9. Type of lighting in place of study _____

10. Position of light to the study area _____

11. Near vision test - child is able to read the book at a distance of 30cm :   ☐ yes   ☐ no

12. Anthropometry-   Height (cm): _____

Weight (kg): _____

13. Screening of eye :

	RIGHT EYE	LEFT EYE
Uncorrected Visual Acuity		
VA with spectacles		
Myopia		
Hypermetropia		
Astigmatism		

Colour blindness: ☐ present   ☐ absent

If present- _____colour

PARENT QUESTIONNAIRE

1. FATHER'S DETAILS:

     Educational status_____

     Occupation   _____

     Is he wearing spectacles/ contact lens ☐ yes   ☐ no

     If yes- diagnosis _____

     Spectacles 1st prescribed at age _____

2. MOTHER'S DETAILS:

     Educational status_____

     Occupation   _____

     Is she wearing spectacles / contact lens ☐ yes   ☐ no

     If yes- diagnosis _____

     Spectacles 1st prescribed at age _____

3. SIBLING DETAILS (only those using spectacles):

     Educational status_____

     Occupation   _____

     If yes- diagnosis _____

     Spectacles 1st prescribed at age _____

4. Total members in the family _____ type of family
     _____

5. Total family income/ month _____

6. Does your child ever complaint of problem in vision?   ☐ yes   ☐ no

7. Was the child ever subjected to ophthalmic examination? ☐ yes ☐ no

      If yes, where ☐ in school camp

                      ☐ By parents with ophthalmic complaints

      Outcome of the check up_____

8. Time spent by the child in doing following activities per day: (in hrs)

      a. For doing school assignment(writing & reading) _____

      b. Reading books other than school books_____

      c. Watching TV_____

      d. Playing video/mobile games_____

      e. Working at computer/ laptop_____

      f. Outdoor activities - Engaging in sports_____

9. How long your child reads continuously without break?

      1. 15 min 2. 30 min 3. 45min 4. 1 hr 5. Others _____

10. Posture of the child while reading –

      ☐ Lying ☐ sitting straight ☐ others_____

11. Child usually watches TV at a distance of about_____ feet

12. How the child does watches television?

      ☐ Looking straight ☐. Slightly turn their head ☐ lying

13. Time spent by the child in Extra classes/ tuition- _____ hrs/day

வினாப்பட்டியல்

வரிசைஎண்.:_____

பள்ளியின் பெயர்.:_____ ☐ அரசு ☐ தனியார்

1. பெயர் :_____

2. வயது: :_____

3. பாலினம்: :ஆண் ☐ பெண் ☐

4. வகுப்பு: :_____

5. முகவரி:-

6. குழந்தை மூக்குகண்ணாடி அணிந்துள்ளதா? ☐ ஆம் ☐ இல்லை

   a)ஆம் எனில் - வழக்கமாககண்ணாடி ☐ ஆம் ☐ இல்லை

   அணிவீர்களா?

   b)இல்லைஎனில் - காரணங்கள்:-

   ☐ தொந்தரவாகஉள்ளது

   ☐ அழுக்குபடிதல்

   ☐ ஈரமாவதால் ஏற்படும் சிரமம்

   ☐ தேடுவது/தொலைப்பது

   ☐ மற்றவர்கள் கேலி/கிண்டல் செய்தல்

   ☐ மற்றவை

7. கதிர்சிதைவுபிழைக்கான அறிகுறிகள்:-

   a) இரட்டைபார்வை ☐ ஆம் ☐ இல்லை

   b) மங்கலானபார்வை ☐ ஆம் ☐ இல்லை

   c) கண் வலி ☐ ஆம் ☐ இல்லை

   d) கண் எரிச்சல் ☐ ஆம் ☐ இல்லை

   e) கண் சிவத்தல் (மாலையில்) ☐ ஆம் ☐ இல்ல

   f) கண்களில் நீர் வடிதல் ☐ ஆம் ☐ இல்லை

g) தலைவலி   ☐ ஆம்   ☐ இல்லை

8. வீட்டின் எந்தபகுதி / அறையில் படிப்பீர்கள் _____

9. விளக்கின் தன்மை_____

10. ஒளியின் நிலை_____

11. 30 செ.மீ. தொலைவில் உள்ளபுத்தகத்தைபடிக்கமுடிகிறதா?   ☐ ஆம்   ☐ இல்லை

12. மனிதரளவையியல்:-

     உயரம் (செ.மீ):-

     எடை (கிலோ):

13. கண் பரிசோதனைவிவரங்கள்:-

		வலதுகண்	இடதுகண்
1	காட்சி கூர்மை		
2	மூக்குகண்ணாடியுடன் காட்சி கூர்மை		
3	கிட்டப்பார்வை		
4	தூரப்பார்வை		
5	சிதறல் பார்வை		

6 நிறக்குருடு:-   உண்டு   இல்லை
உண்டுஎனில் _____ திறம்.

பெற்றோருக்கானவினாப்பட்டியல்

1. தந்தையின் விவரங்கள்:-

    கல்விவிவரம்:_____

    தொழில்   :_____

    மூக்குகண்ணாடி/தொடுவில்லை(Contact Lens) அணிபவரா:-

    ☐ ஆம்   ☐ இல்லை

    ஆம் எனில்,காரணம் :_____

    எந்தவயதிலிருந்துகண்ணாடிஉங்களுக்குபரிந்துரைக்கப்பட்டது:_____

2. தாயாரின் விவரங்கள்:-

    கல்விவிவரம்:_____

    தொழில்   :_____

    மூக்குகண்ணாடி/தொடுவில்லை(Contact Lens) அணிபவரா:-

    ☐ ஆம்   ☐ இல்லை

    ஆம் எனில்,காரணம் :_____

    எந்தவயதிலிருந்துகண்ணாடிஉங்களுக்குபரிந்துகைக்கப்பட்டது:_____

3. உடன் பிறந்தோரின் விவரங்கள்:- (கண்ணாடிஅணிபவரின் விவரங்கள் மட்டும்)

    கல்விவிவரம்:_____

    தொழில்   :_____

    மூக்குகண்ணாடி/தொடுவில்லை(Contact Lens) அணிபவரா:-

    ☐ ஆம்   ☐ இல்லை

    ஆம் எனில்,காரணம் :_____

எந்தவயதிலிருந்துகண்ணாடிஉங்களுக்குபரிந்துரைக்கப்பட்டது:_____

4. குடும்பஉறுப்பினர்களின் எண்ணிக்கை: _____

5. குடும்பத்தின் மாதவருமானம் (மொத்தம்): ரூ. _____

6. பார்வையில் பிரச்சனைஉள்ளதாகஉங்கள் குழந்தை கூறியுள்ளதா?

☐ ஆம் ☐ இல்லை

7. இதற்குமுன் உங்கள் குழந்தைக்குகண் பரிசோதனைசெய்யப்பட்டுள்ளதா?

☐ ஆம் ☐ இல்லை

ஆம் எனில்,எங்கு   ☐ பள்ளியில் மருத்துவமுகாம்

☐ மருத்துவரிடம் (பெற்றோர்) நீங்கள் அழைத்துசென்றது

☐ மற்றவை

அந்தப் பரிசோதனையின் முடிவு _____

8. உங்கள் குழந்தைஒருநாளைக்குஎவ்வளவுநேரம் பின்வரும் செயல்களில் ஈடுபடுகிறது? (மணிநேரங்களில்)

i) வீட்டுப்பாடம் (படித்தல் + எழுதுதல்): _____

ii) பாடப் புத்தகம் தவிறவேறுபுத்தகங்கள் படித்தல்: _____

iii) தொலைக்காட்சி (டி.வி.) பார்த்தல்: _____

iv) மொபைலில் விளையாடுதல்: _____

v) கணினி/மடிக்கணினிஉபயோகித்தல்: _____

vi) வீட்டிற்குவெளியேசகுழந்தைகளுடன் விளையாடுதல்: _____

9. உங்கள் குழந்தை இடைவெளி இல்லாமல் தொடர்ந்துஎவ்வளவுநேரம் படிக்கிறது?

1.15min,   2.30min   3.45min   4.1hr   5._____

10. படிக்கும் பொழுதுஉங்கள் குழந்தையின் தோற்றப்பாங்குஎன்ன?

☐ உட்கார்ந்து ☐படுத்துக்கொண்டு☐சாய்ந்தநிலையில்   வேறு_____

11. உங்கள் குழந்தைஎவ்வளவுதொலைவிலிருந்து டி.வி. பார்க்கிறது?

_____ அடிதொலைவு

12. டி.வி. பார்க்கும் பொழுதுஉங்கள் குழந்தையின் தோற்றப்பாங்கு?

நேராகஅமர்ந்து

ஒருபுறமாகதலையைசாய்த்துக் கொண்டு

படுத்துக் கொண்டு

13. உங்கள் குழந்தை கூடுதல் வகுப்புகள்/டியூசன் செல்கிறதா?☐ ஆம்   ☐ இல்லை

ஆம் எனில்,ஒருநாளைக்கு_____ மணிநேரம்

ANNEXURE 4

**SOCIO ECONOMIC CLASS BASED ON
MODIFIED B.G.PRASAD'S CLASSIFICATION**

Modified B.G. Prasad's classification was used for socio economic classification, based on the per capita monthly income of the family.

The calculation was done as follows:

Centre wise Consumer Price Index for All India for the month of July 2015 = 263

Multiplying factor = Current index value (263) / Base index value in 2001 (100) = 2.63.

Modified BG Prasad's classification for July 2015 –

New income value = $2.63 \times$ (old value $\times 4.63 \times 4.93$)

[Correction Factor (CF) = 4.93]

Class	Old classification, 1961 (Rs./m)	For July, 2015 (Rs./m)
I	100 & above	>6003
II	50-99	3002 – 6002
III	30-49	1801 – 3001
IV	15-29	901 – 1800
V	<15	< 901

ANNEXURE 5

LIST OF BLOCKS IN KRISHNAGIRI DISTRICT

1.Uthangarai

2.Krishnagiri

3.Hosur

4.Bargur

5.Veppanapalli

6.Shoolagiri

7.Kaveripattinam

8.Kelamangalam

9.Thally

10.Mathur

Blocks selected in bold letters were the two blocks selected for the study.

ANNEXURE 6

LIST OF SCHOOLS IN SELECTED BLOCKS

1. PRIVATE SCHOOLS OF KRISHNAGIRI BLOCK

ANNAMALAIYAR AIDED PRIMARY SCHOOL	ANNAI N&P SCHOOL
R.C.FATHIMA AIDED PRI – BOYS	EXCEL N & P
R.C. AIDED PRIMARY – GIRLS	VELANKANNI PUBLIC
IELC AIDED MIDDLE SCHOOL	SRI.VIJAYA VIDHYALAYA MATRIC
R.C. FATHIMA HIGH SCHOOL –BOYS	BEST MATRICULATION K.GIRI
ST.ANNES HSS AIDED GIRLS	SARASWATHI VIDYALAYA N&P MADEP
SRI RAMAKRISHNA VIDYALAYA BALA	**SVC MAT.MARIKKAMPALLI**
LITTLE FLOWER N&P BALAGURI	MTV MAT. HSS MALLINAYANAPALLI
ANNAI ADHIPARASAKTHI N&P,BETEPALLI	CAMBRIDGE MAT. SRIRAM NAGAR
MANCHESTOR N&P GIDDAMPATTI	TRINITY MATRICULATION K.GIRI
DURAI'S N&P SCHOOL	NALANDA MAT. HSS PERIYAMOTTOR
ANNAI INDRAGANDHI N&P	DON BOSCO HSS K.GIRI
VIKAS BLUE BELLS N&P	BHARAT MAT. HSS NEWPET K.GIRI
SHATHANAI HITECH N&P	VAILANKANNI MAT. HSS RAYAPPA
UNIVERSAL N& P PERIYA MUTTUR	D.K. SAMY MAT. K.GIRI
LITTLE STAR N & P SCHOOL,	MAHARISHI MATRIC SCHOOL K.GIRI
SEVENTH DAY ADVENTISTS K.GIRI	KRISHILAND MATRIC SCHOOL.
SARASWATHI NUR. POOKAR ST.	NALANDH INTRNATIONAL SCHOOL
LITTLE STAR NURSERY K.GIRI	TES HSS-UN-AIDED KATHALAMEDU
A.R.G. NUR. BHARATHI NAGAR	SRI SAI KRISHNA VID MAT,AVATHA
NALANDA NUERSERY K.GIRI	D.K.SAMI N&P
ST. ANNES NURSERY K.GIRI	ROTARY TRUST TNHB COLONY
WISDOM MATRICULATION K.GIRI	VIJAYA MILLINENIUM CBSE
HARISH VIDYALAYA NUR. PRI.	CAMBRIDGE PUBLIC MATRIC
KRISHILAND N & P TNHB COLONY	RIMS MATRIC
SRI VIDYA MANDIR N&PSRINIVASA	TCR N&P
MOTHER THERASA N&P	SWAMI VIVEKANANDA MAT. HSS
I.T.KIDS N&P KRISHNAGIRI	EDEN GARDEN ENGLISH SCHOOL
VIJAYAVIDHIYALAYA N& P SCHOOL	BHARATH INTERNATIONAL

2. GOVERNMENT SCHOOLS OF KRISHNAGIRI BLOCK

PUMS AGRAHARAM	MMS OLD PET - TAMIL
PUMS BALAGURI	MMS FORT URDU GIRLS - OLDPET
PUMS BALIGANOOR	MMS OLD SUB JAIL ROAD
PUMS BELLAMPALLI	MMS RAJU STREET
PUMS BOGANAPALLI	GHS AGARAMITTIKKAL
PUMS DASIRIPALLI	**GHS BELLARAMPALLI**
PUMS EAKKALNATHAM	GHS BETTEPALLI
PUMS GOLLAHALLI	GHS CHICKKAPOOVATHI
PUMS K.A.NAGAR (TAMIL)	GHS CHINNAMELUPALLI
PUMS KALLAKURIKKI	GHS GENGALERI
PUMS KOTHUR - GIRLS – URDU	GHS GIDDAMPATTI
PUMS MELERIKOTTAI	GHS GUMMANUR
PUMS-NARALAPALLI	GHS JAGIR VENKATAPURAM
PUMS OBELESAPALLI	GHS KAMMAMPALLI
PUMS PEDDATHALAPALLI	GHS.KATTIKANAPALLI PUDUR
PUMS PERIYATHAGGEPALLI	GHSMADHEPATTI
PUMS R.POOSARIPATTY	GHS MAHARAJA KADAI
PUMS THUDUGANAHALLI	GHS MADHINAYANAPALLI
PUMS THURINJIPATTI	GHS GIRLS MEKALA CHINNAMPI
PUMS VELAGALAHALLI	GHS MITTAPALLI
PUMS BANDARAPALLI	GHS PERIYA KOTTAPALLI
PUMS PEDDANAPALLI	GHS POTHINAYANAPALLI
PUMS SEMBADAMUTHUR	GHS SOKKADU
MMS ANNANAGAR	GHS K.POOSARIPATTI
MMS DOWLATHABAD – URDU	GHS NEKKUNDHI
MMS GANDHI ROAD -BOYS- URDU	GHS PATCHIKANAPALLI

3. GOVERNMENT SCHOOLS OF KAVERIPATTINAM BLOCK

PUMS BENDRAHALLI	GHS BALEGULI
PUMS SATHINAICKANPATTI	GHS BANNIHALLI
PUMS K.MOTTUR	**GHS BANNIHALLI PUDUR**
PUMS KAVERIPATTANAM - URDU	GHS CHETTIMARAMAPATTI
PUMS KEELKUPPAM	GHS KOORAMPATTI
PUMS MANI NAGAR	GHS KADHIRIPURAM
PUMS MARICHETTIHALLI	GHS NATTANMAI KOTTAI
PUMS MITTAHALLI	GHS PANNANDUR - GIRLS
PUMS N.THATTAKKAL	GHS PERIYAKARADIYUR
PUMS NARIMEDU	GHS RAMAPURAM
PUMS PENNESWARA MADAM	GHS SOBANOOR
PUMS POTHAPURAM	GHS THIMMAPURAM
PUMS PULIYAMPATTI	GHS THOPPUR
PUMS SAVALOOR	GHS VADAMANGALAM
PUMS THERPATTI	GHS VILANGAMUDI
PUMS VEERAMALAI	GHS GUNDALAPATTI
PUMS BERUHALLI	GHS JAGADAB
PUMS DEVARMUKKULAM	GHS KALVEHALLI
PUMS DEVEERAHALLI	GHS KARAGUR
PUMS THALIHALLI	GHS METTU PULIYUR
GGHS ARASAMPATTI	

4. PRIVATE SCHOOLS OF KAVERIPATTINAM BLOCK

ANNA ARIVAGAM ARASAMPATTI
SRI VINAYAGA VIDHYALAYA N & P KALKUTTAPATTI
VEDHA NURSERY & PRIMARY POTHAPURAM
ST. PAULS ,ANNA NAGAR,KPTM
SRI SARASWATHI VIDHYALAYA
ST DANIS N&P SCHOOL, KAVERIPATTINAM
ST. PAULS KOTTA STREET, KPTM
PSG PUBLIC N & P SCHOOL KAVERIPATTINAM
SEVEN HILLS GANDHI NAGAR KPTM
ASHOK MISSION N&P KOTTAVOOR
NATIONAL ;N&P NADUPPAIYUR
SREE MARUTHI INNOVA KIDS N & P SCHOOL
SRI SAM N&P NEDUNGAL
SREE GOKULAM N&P PANNANDUR
SRI MATHI NUSERY
ST.DANIS N& P, AGARAM ROAD,KPTM
GITANJALI N&P SCHOOL
SRI VINAYAGA N&P SCHOOL
VIJAYABHARATHI N&P SELLAMPATTI
SEVEN HILLS BARUR
SREE VIDHYAMANDIR N&P JAGADAB
LITTLE FLOWER METTUPULIYUR
SRI RAMAKRISHNA MATRICULATION
NATIONAL HR.SEC.SCH VARATAMPATTI
GOPI KRISHNA P&N DASAMPATTI
ROYAL MAT. ARS NAGAR
GREENVELI MATRIC SCHOOL PANNANDHUR
CAMBRIDGE PUBLIC e-,KPTM
SRI RAJA RAJESWARI TAPOVANAM
THIRU ARUT PRAKASHA MATRIC THIMMA
NATIONAL MAT. VARATAMPATTI

Schools selected in bold letters were selected for the study

KEY TO MASTER CHART

Variable	Label	Coding
S.No	Serial Number	1,2 etc
School_cat	Type of School	1=Govt, 2=Private
Age	Age of Participant	1,2,3 etc
Gender	Gender of Participant	1=Male, 2=Female
Class	Class	6,7,8
Religion	Religion of Participant	1=Hindu, 2=Christian, 3=Muslim
Father Edu	Education of Father	0=No formal education, 1=Primary, 2=Middle, 3=High school, 4=Graduate, 99=Nil
Mother Edu	Education of Mother	0=No formal education, 1=Primary, 2=Middle, 3=High school, 4=Graduate
Father Occu	Occupation of Father	1=Unskilled, 2=Semi Skilled, 3=Skilled, 4=Semi professional
Mother Occu	Occupation of Mother	1=Working mother, 2=Home maker
Family_type	Type of Family	1=Nuclear, 2=Three generation, 3=Joint
Family_Mem	Total members in the family	1,2,3 etc
Family_Inc	Total family Income	
Parcapita	Percapita income of the family	
SES	SE scale as per BG Prasad classification	1,2,3,4,5

Double_v	Double vision	1=Yes, 2=No
Blur_v	Blurred vision	1=Yes, 2=No
Eye_pain	Pain	1=Yes, 2=No
Irritation	Irritation of Eye	1=Yes, 2=No
Redness	Redness	1=Yes, 2=No
Watering	Watering	1=Yes, 2=No
Headache	Headache	1=Yes, 2=No
Spectacles	Wearing spectacles	1=Yes, 2=No
Regular_use	Regular use of spectacles	1=Yes, 2=No, 99=Nil
Irreg_use	Irregular use of spectacles	1=Bothers one, 2=dirty specs, 3=Fogged, 4=Losing specs, 5=Teased by others, 99=Nil
HT	Height in meters	
WT	Weight in Kg	
BMI_per	BMI percentile	
BMI_cat	BMI	1=UnderWeight, 2=Normal, 3=OverWeight, 4=Obese
VA_RE	Visual acuity in right eye	
VA_LE	Visual acuity in left eye	
VA_SPECS	Visual acuity with spectacles	1= normal, 2= under correction, 99=nil
RE	Refractive error	1=present, 2=absent
RE_TYPE	Type of refractive error	1=myopia, 2= hyperopia,99=nil
Color_Blind	Colour blindness	1=present, 2=absent
Par_h/o	Parental history of RE	1= father, 2=mother, 3=both,4=none

Sibling_h/o	Sibling history of refractive error	1=present, 2=absent
Scl_hw	Time spent in doing school work	1=30 min, 2=1 hr, 3=1.30 hr, 4=2 hr, 5=>2 hr
Sclhw_cat	School work category	1=< 2hr, 2= 2hr>=
Oth_book	Reading books other than school books	1=30 min, 2=1 hr, 3=1.30 hr, 4=2 hr, 5=>2 hr
othB_cat	Reading books other than school books category	1=< 1 hr, 2=> 1 hr
Tv_dur	Time spent in watching tv	1=30 min, 2=1 hr, 3=1.30 hr, 4=2 hr, 5=>2 hr
Mob_gam	Time spent in playing mobile/video games	1=< 1 hr, 2=> 1 hr
Comp_dur	Time spent in using computer	1=30 min, 2=1 hr, 3=1.30 hr, 4=2 hr, 5=>2 hr, 88=nil
outdoor	Time spent in outdoor activities	1=< 2hr, 2=>=2hr
Cont_read	Continuous reading time	1=< 30 min, 2=>30 min
Tv_dis	Distance of watching tv	1=<10 feet, 2=>10 feet
Tv_pos	Posture of watching tv	1=looking straight, 2=turns head to one side, 3=lying
Study_Pl	Place of study	1=hall,2=bedroom,3=study room,4=verandah
dimlight	Reading in dimlight	1=yes,2=no
Read_pos	Reading posture	1=sitting straight, 2=others
tuition	Children attending tuition	1=yes, 2=no

MASTER CHART

S.No	School_cat	Age	Gender	Class	Religion	Father Edu	Mother Edu	Father Occu	Mother Occu	Family_type	Family_Mem	Family_Inc	Percapita	SES	Double_v	Blur_v	Eye_pain	Irritation	Redness	Watering	Headache	Spectacles	Regular_use	Irreg_use	HT	WT	BMI_per	BMI_cat	VA_RE	VA_LE	VA_SPECS	RE	RE_TYPE	Color_Blind	par_h/o	scl_hw	sclhw_cat	oth_books	othb_cat	TV_dur	mob_gam	comp_dur	outdoor	cont_read	tv_dis	tv_pos	study_pl	dimlight	read_pos	tuition
1	1	12	2	7	1	99	3	3	1	1	6	5000	833	5	2	2	2	2	2	2	2	2	99	99	1.43	35	15.5	2	6_6	6_6	99	2	99	2	4	4	2	88	nil	3_1	88	1	1	2	2	1	2	1	2	2
2	1	11	2	7	1	3	3	3	2	1	5	5000	1000	4	2	2	2	2	2	2	2	2	99	99	1.37	28	8.7	2	6_6	6_6	99	2	99	2	4	2	1	88	nil	2_nil	88	1	1	1	2	1	2	1	2	2
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```
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52   1 11 1 6 1 2 3 3 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.3 30 57 2.6_6 6_6 99 2 99 2 4 5 2 2 1 2 nil 88 1 1 2 2 1 2 1 2
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319  1 13 1 8 1 1 0   0 2 1 5  8000  1600  4 2 2 2 2 2 2 2   2  99 99 1.42  30   1.1   16_6  6_6   99 2 99  2 4 4 2  11     11     88 1 1 2 2 1 2 1 2
320  1 13 1 8 1 3 3   3 2 1 4  6000  1500  4 2 2 2 2 2 2 2   2  99 99 1.44  30   0.5   16_6  6_6   99 2 99  2 4 3 1  11     11     88 1 1 2 2 2 2 1 2
321  1 13 1 8 1 3 1   1 2 1 5  5000  1000  4 2 2 2 2 2 2 2   2  99 99 1.38  30   7.6   26_6  6_6   99 2 99  2 4 1 1  88 nil  52     88 1 1 2 1 1 2 1 2
322  1 12 1 8 1 1 2   2 2 1 6  4000  666   5 2 2 2 2 2 2 2   2  99 99 1.37  25   0     16_6  6_6   99 2 99  2 4 1 1  88 nil  52     88 1 2 2 1 1 2 1 2
323  1 12 2 6 1 4 3   3 2 1 4  5000  1250  4 2 2 2 2 2 2 2   2  99 99 1.35  25   0.3   13_60 3_60  99 1 1   1 1 2 1  88 nil  51     1  1 1 1 2 1 2 1 2
324  1 14 2 8 1 1 1   1 2 2 5  5000  1000  4 2 2 2 2 2 2 2   2  99 99 1.4   34   17.6  26_6  6_6   99 2 99  2 4 2 1  88 nil  1 nil  88 1 1 1 1 1 1 1 2
325  1 14 2 8 1 2 3   3 2 1 4  15000 3750  2 1 1 2 2 2 1 2   2  99 99 1.6   37   0.2   16_6  6_24  99 1 1   2 4 4 2  11     21     88 1 1 2 1 1 2 1 2
326  1 14 2 8 1 3 2   2 2 1 5  10000 2000  3 2 2 2 2 2 2 2   2  99 99 1.42  27.5 0     16_6  6_6   99 2 99  2 4 2 1  88 nil  2 nil  88 1 1 2 1 4 1 1 2
327  1 13 1 8 1 2 3   3 2 1 4  5000  1250  4 2 2 2 2 2 2 2   2  99 99 1.36  28   2.8   16_6  6_6   99 2 99  2 4 2 1  11     1 nil  88 1 1 1 2 1 2 2 1
328  1 12 1 7 1 3 3   3 2 1 5  6000  1200  4 2 2 2 2 2 2 2   2  99 99 1.35  24   0     16_6  6_6   99 2 99  2 1 2 1  88 nil  88 nil 88 1 2 99 2 1 2 1 2
329  1 12 1 7 1 3 3   3 2 1 4  2000  500   5 2 2 2 2 2 2 2   2  99 99 1.38  29   5.1   26_6  6_6   99 2 99  2 4 1 1  88 nil  2 nil  88 1 1 1 1 4 1 1 2
330  1 12 1 6 1 2 3   3 2 1 4  10000 2500  3 2 2 2 2 2 2 2   2  99 99 1.36  29   9.4   26_6  6_6   99 2 99  2 4 4 2  11     21     88 1 1 2 1 1 2 1 2
331  1 13 1 7 1 1 1   1 2 1 4  35000 8750  1 2 2 2 2 2 2 2   2  99 99 1.5   36   6.9   26_6  6_6   99 2 99  1 4 2 1  11     51     88 1 2 1 2 1 2 1 2
332  1 12 1 7 1 2 3   3 2 1 6  5000  833   5 2 2 2 2 2 2 2   2  99 99 1.39  34   38.9  26_6  6_6   99 2 99  2 4 2 1  11     4 nil  88 1 1 1 2 4 2 1 2
333  1 12 2 7 1 3 3   3 2 1 3  5000  1666  4 2 1 2 2 2 1 1   2  99 99 1.45  27   0     15_60 6_36  99 1 1   2 4 5 2  11     2 nil  88 1 2 1 1 1 2 1 2
334  1 14 1 8 1 1 0   0 2 1 4  5000  1250  4 2 2 2 2 2 2 2   2  99 99 1.36  32   17.3  26_6  6_6   99 2 99  2 4 4 2  11     1 nil  88 1 2 1 1 1 1 1 2
335  1 11 1 6 1 3 2   2 2 2 5  1000  200   5 2 2 2 2 2 2 2   2  99 99 1.45  31   5.9   26_6  6_6   99 2 99  2 4 4 2  88 nil  21     88 3 1 1 2 1 2 1 2
336  1 11 1 6 1 3 2   2 2 2 6  5000  833   5 2 2 2 2 2 2 2   2  99 99 1.34  34   73.6  26_6  6_6   99 2 99  1 4 4 2  88 nil  2 nil  88 1 2 1 1 2 2 1 2
337  1 11 2 6 1 1 1   1 2 1 6  9000  1500  4 2 2 2 2 2 2 2   2  99 99 1.35  25   1.3   16_6  6_6   99 2 99  2 4 2 1  88 nil  4 nil  88 1 2 2 1 4 1 1 2
338  1 12 1 7 1 3 0   0 2 2 6  10000 1666  4 2 2 2 2 2 2 2   2  99 99 1.4   29.5 4.2   16_6  6_6   99 2 99  2 4 3 1  88 nil  1 nil  88 1 2 2 1 1 1 1 2
339  1 12 1 6 1 1 3   3 2 1 4  5000  1250  4 2 2 2 2 2 2 2   2  99 99 1.3   25   2.6   16_6  6_6   99 2 99  2 4 4 2  21     2 nil  88 1 1 1 2 1 2 1 2
340  1 11 1 6 1 2 2   2 2 1 5  6000  1200  4 2 2 2 2 2 2 2   2  99 99 1.36  28   9.6   26_6  6_6   99 2 99  2 4 2 1  11     1 nil  88 1 2 2 1 2 1 1 2
341  1 11 2 6 1 3 3   3 2 2 7  10000 1428  4 2 2 2 2 2 2 2   2  99 99 1.3   25   7.9   26_6  6_6   99 2 99  2 4 2 1  88 nil  11     88 1 1 2 1 4 2 1 2
342  1 12 1 6 1 3 2   2 2 1 4  1000  250   5 2 2 2 2 2 2 2   2  99 99 1.46  28   0     16_6  6_6   99 2 99  2 4 2 1  88 nil  2 nil  88 1 2 2 1 1 1 1 2
343  1 11 1 6 1 3 2   2 2 1 4  2000  500   5 2 2 2 2 2 2 2   2  99 99 1.32  25.5 3.3   16_6  6_6   99 2 99  2 4 1 1  11     21     1  1 1 1 2 1 1 2 1 1
344  1 14 1 8 1 1 0   0 2 1 4  8000  2000  3 2 2 2 2 2 2 2   2  99 99 1.33  24   0     16_6  6_6   99 2 99  2 4 2 1  11     31     88 1 1 1 1 4 1 1 2
345  1 14 1 8 1 3 2   2 2 1 4  7000  1750  4 2 2 2 2 2 2 2   2  99 99 1.33  27   0.9   16_6  6_6   99 2 99  2 4 2 1  11     2 nil  88 1 1 1 1 4 1 1 2
346  1 12 1 7 1 2 2   2 2 1 5  3000  600   5 2 2 2 2 2 2 2   2  99 99 1.26  24.5 6.9   26_6  6_6   99 2 99  2 4 2 1  88 nil  21     88 3 1 1 2 1 2 1 2
347  1 13 1 8 1 1 0   0 2 2 6  3000  500   5 2 2 2 2 2 2 2   2  99 99 1.34  31   23.3  26_6  6_6   99 2 99  2 4 1 1  88 nil  3 nil  88 1 1 1 1 2 2 1 2
348  1 11 1 6 1 3 1   1 2 2 7  2000  286   5 2 2 2 2 2 2 2   2  99 99 1.39  23.5 0     16_6  6_6   99 2 99  2 4 2 1  88 nil  2 nil  88 1 1 2 1 2 1 1 2
349  1 13 2 8 1 1 2   2 2 1 4  1000  250   5 2 2 2 2 2 2 2   2  99 99 1.5   33   1.3   16_6  6_6   99 2 99  2 4 2 1  88 nil  2 nil  88 1 2 2 1 4 2 1 2
350  1 14 2 8 1 3 3   3 2 1 4  5000  1250  4 2 2 2 2 2 2 2   2  99 99 1.46  44   63.3  26_6  6_6   99 2 99  2 4 2 1  11     4 nil  88 1 2 2 1 1 2 1 2
351  1 13 2 8 1 3 2   2 2 1 4  2500  625   5 2 2 2 2 2 2 2   2  99 99 1.55  50.5 72.8  26_6  6_6   99 2 99  2 4 2 1  11     2 nil  88 1 1 2 1 2 2 1 2
352  1 13 2 8 1 2 2   2 2 1 6  10000 1666  4 2 2 2 2 2 2 2   2  99 99 1.45  34   11.2  26_6  6_6   99 2 99  2 4 2 1  11     88 nil 88 1 2 99 2 1 2 1 1
353  1 13 1 8 1 3 2   2 2 1 4  2000  500   5 2 2 2 2 2 2 2   2  99 99 1.42  33   14.1  26_6  6_6   99 2 99  2 4 2 1  88 nil  41     88 3 1 1 1 2 2 1 2
354  1 13 1 8 1 0 1   1 2 1 5  7000  1400  4 2 2 2 2 2 2 2   2  99 99 1.38  31   13.6  26_6  6_6   99 2 99  2 4 2 1  88 nil  4 nil  88 1 1 2 1 2 1 1 2
355  1 14 1 8 1 1 0   0 2 3 9  4000  444   5 2 2 2 2 2 2 1   2  99 99 1.41  32   3.8   16_6  6_6   99 2 99  2 4 2 1  11     41     88 1 1 2 1 4 1 1 2
356  1 13 1 8 1 1 1   1 2 1 8  2000  250   5 2 2 2 2 2 2 2   2  99 99 1.37  29   3.5   16_6  6_6   99 2 99  2 4 2 1  88 nil  2 nil  88 1 1 1 1 2 2 1 2
357  1 14 1 8 1 3 3   3 2 1 3  5000  1666  4 2 2 2 2 2 2 1   1  2  5 1.48  36   8.6   26_12 6_12  1 1 1   2 4 5 2  88 nil  1 nil  88 1 1 1 2 4 2 1 1
358  1 13 2 7 1 2 2   2 2 1 5  10000 2000  3 2 2 2 2 2 2 2   2  99 99 1.4   30.5 4.2   16_12 6_12  99 1 1   2 4 2 1  88 nil  88 nil 88 3 2 99 2 2 2 1 2
359  1 12 1 7 1 2 3   3 2 1 3  5000  1666  4 2 2 2 2 2 2 2   2  99 99 129   26   8.1   26_6  6_6   99 2 99  2 4 2 1  88 nil  2 nil  88 3 2 2 1 2 1 2
360  1 13 1 7 1 2 3   3 2 1 5  4000  800   5 2 2 2 2 2 2 2   2  99 99 1.6   40   3.5   26_6  6_6   99 2 99  2 4 2 1  88 nil  3 nil  88 1 1 2 1 2 2 1 2
361  1 13 1 8 1 1 0   0 2 1 3  2000  666   5 2 2 2 2 2 2 2   2  99 99 1.4   28   0.1   16_6  6_6   99 2 99  2 4 2 1  11     31     88 1 1 1 1 2 2 1 2
362  1 12 2 6 1 2 0   0 2 2 5  2000  400   5 2 2 2 2 2 2 2   2  99 99 1.32  26   3.1   16_6  6_6   99 2 99  2 4 2 1  11     2 nil  88 3 2 2 1 2 2 1 2
363  1 13 2 6 1 2 3   3 2 1 4  1000  250   5 2 2 2 2 2 2 2   2  99 99 1.45  37   28.6  26_6  6_6   99 2 99  2 4 3 1  11     21     88 1 1 2 2 2 2 1 2
364  1 12 1 6 1 3 3   3 2 2 5  5000  1000  4 2 2 2 2 2 2 2   2  99 99 1.47  34.5 12.1  26_6  6_6   99 2 99  2 4 5 2  88 nil  21     88 1 1 1 1 4 2 1 1
365  1 11 1 6 1 2 1   1 2 1 5  1000  200   5 2 2 2 2 2 2 2   2  99 99 1.18  19   0.4   16_6  6_6   99 2 99  2 4 2 1  11     31     88 3 1 1 1 4 1 1 1
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366 1 12 1 6 1 99 3 3 2 1 4 3000 750 5 2 2 2 2 2 2 2 2 99 99 1.33 26.5 3.8 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 2 2 1 4 2 1 2
367 1 11 1 6 1 2 3 3 2 1 4 5000 1250 4 2 2 2 2 2 2 2 2 99 99 1.37 28 8.2 2 6,6 6,6 99 2 99 2 4 2 1 1 1 2,1 88 1 2 2 1 1 2 1 2
368 1 11 1 6 1 2 3 3 2 2 5 8000 1600 4 2 2 2 2 2 2 2 2 99 99 1.4 26 0.1 1 6,6 6,6 99 2 99 2 1 2 1 88 nil 2 nil 88 1 1 1 2 2 2 1 2
369 1 12 2 6 1 0 2 2 2 1 3 7000 2333 3 2 2 2 2 2 2 2 2 99 99 1.42 31.5 11.2 2 6,6 6,6 99 2 99 2 4 4 2 4 2 1 1 88 1 1 2 1 2 2 1 2
370 1 11 2 6 1 3 3 3 2 1 5 12000 2400 3 2 2 2 2 2 2 2 2 99 99 1.32 27 13.2 2 6,6 6,6 99 2 99 2 4 4 2 2 1 2 nil 88 1 1 2 1 1 2 1 2
371 1 11 1 6 1 2 3 3 2 1 4 5000 1250 4 2 2 2 2 2 2 2 2 99 99 1.47 38 48.8 2 6,6 6,6 99 2 99 2 4 5 2 1 1 2,1 88 1 2 1 1 2 2 1 2
372 1 12 2 6 1 3 3 3 2 1 5 2000 400 5 2 2 2 2 2 2 2 2 99 99 1.42 37 53.6 2 6,6 6,6 99 2 99 2 1 4 2 2 1 2,1 88 1 1 2 1 1 2 1 2
373 1 11 1 6 1 2 3 3 2 1 6 10000 1666 4 2 2 2 2 2 2 2 2 99 99 1.42 27 0.1 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 3,1 88 1 2 2 2 2 1 1 2
374 1 12 2 6 1 3 3 3 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.38 26 0.3 1 6,6 6,6 99 2 99 2 4 3 1 2,1 1 1 1 2 2 1 1 2 1 2
375 1 12 2 7 1 3 0 0 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.49 37 21.3 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 2 nil 88 1 1 2 1 1 2 1 2
376 1 12 2 7 1 3 1 1 2 2 8 15000 1875 3 2 2 2 2 2 2 2 2 99 99 1.4 27 0.3 1 6,6 6,6 99 2 99 2 4 2 1 1 1 3,1 88 1 2 2 1 1 2 1 2
377 1 12 2 7 1 3 3 3 2 2 8 7000 875 5 2 2 2 2 2 2 2 2 99 99 1.45 28 0 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 2 1 1 1 2 1 2
378 1 12 1 7 1 3 3 3 2 1 4 5000 1250 4 2 2 2 2 2 2 2 2 99 99 1.46 42 72.7 2 6,6 6,6 99 2 99 2 4 2 1 1 1 2,1 88 1 2 1 1 2 2 1 2
379 1 12 1 7 1 1 0 0 2 1 5 8000 1600 4 2 2 2 2 2 2 2 2 99 99 1.33 26 2.5 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 1,1 88 1 2 1 1 1 1 1 2
380 1 12 1 7 1 1 0 0 2 1 6 8000 1333 4 2 2 2 2 2 2 2 2 99 99 1.31 23 0 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 2 1 1 1 1 1 2
381 1 12 1 7 1 3 0 0 2 1 5 2000 400 5 2 2 2 2 2 2 2 2 99 99 1.34 32 44.6 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 4 nil 88 1 2 1 1 1 2 1 2
382 1 12 1 7 1 2 2 2 2 1 5 3000 600 5 2 2 2 2 2 2 2 2 99 99 1.46 28 0 1 6,6 6,6 99 2 99 2 4 4 2 1 1 2,1 88 1 2 1 1 1 2 1 2
383 1 12 2 7 1 0 2 2 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.42 28.5 0.8 1 6,6 6,6 99 2 99 2 4 5 2 88 nil 2,1 88 1 1 2 1 1 2 1 2
384 1 12 2 7 1 2 0 0 2 1 4 5000 1250 4 2 2 2 2 2 2 2 1 99 99 1.24 24 8.3 2 6,6 6,6 99 2 99 2 4 3 1 88 nil 1 nil 88 1 2 1 1 1 2 1 2
385 1 12 2 7 1 2 2 2 2 1 4 7000 1750 4 2 2 2 2 2 2 2 2 99 99 1.47 32 2.6 1 6,6 6,6 99 2 99 2 4 1 1 88 nil 1 nil 88 3 1 1 2 1 2 1 2
386 1 12 1 7 1 2 3 3 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.32 25 1 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 3 nil 88 1 1 1 2 2 1 1 2
387 1 12 2 7 1 3 3 3 2 1 5 3000 600 5 2 2 2 2 2 2 2 2 99 99 1.18 17 0 1 6,6 6,6 99 2 99 2 1 4 2 1 1 3,1 88 1 2 1 2 1 2 1 2
388 1 12 2 7 1 3 2 2 2 1 3 5000 1666 4 2 2 2 2 2 2 2 2 99 99 1.38 27.5 2.2 1 6,6 6,6 99 2 99 2 4 2 1 88 nil 2 nil 88 1 1 1 1 1 2 1 2
389 1 12 2 7 1 3 2 2 2 1 4 3000 750 5 2 2 2 2 2 2 2 2 99 99 1.45 35.5 28.5 2 6,6 6,6 99 2 99 2 4 4 2 88 nil 3,1 88 1 2 1 2 1 2 1 2
390 1 12 2 7 1 2 0 0 2 1 4 5000 1250 4 2 2 2 2 2 2 2 2 99 99 1.42 36 44.7 2 6,6 6,6 99 2 99 2 4 3 1 88 nil 2,1 88 1 2 1 2 1 2 1 2
391 1 12 2 7 1 1 0 0 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.36 33 45.2 2 6,6 6,6 99 2 99 2 4 4 2 1 1 2,1 88 1 2 1 2 4 2 1 2
392 1 12 2 7 1 1 1 1 2 1 6 8000 1333 4 2 2 2 2 2 2 2 2 99 99 1.48 37 30.2 2 6,6 6,6 99 2 99 2 4 3 1 1 1 3,1 88 1 1 1 1 2 2 1 2
393 1 12 2 7 1 3 2 2 2 1 6 2000 333 5 2 2 2 2 2 2 2 2 99 99 1.34 26 2.3 1 6,6 6,6 99 2 99 2 4 1 1 88 nil 2,1 88 1 2 1 1 1 1 1 2
394 1 12 2 6 1 3 3 3 2 1 3 5000 1666 4 2 2 2 2 2 2 2 2 99 99 1.26 25 9.2 2 6,6 6,6 99 2 99 2 4 3 1 88 nil 3 nil 88 1 2 1 1 2 2 1 2
395 1 12 1 7 1 3 1 1 2 1 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.4 31 9.6 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 2 1 1 1 2 1 2
396 1 11 2 6 1 3 3 3 2 1 4 6000 1500 4 2 2 2 2 2 2 2 2 99 99 1.55 51 84.1 2 6,24 6,36 99 1 1 2 4 2 1 88 nil 2 nil 88 1 1 1 2 1 1 1 2
397 2 12 1 8 1 4 3 3 2 1 4 30000 7500 1 2 2 2 2 2 2 2 2 99 99 1.5 47 81.7 2 6,24 6,24 99 1 1 2 4 5 2 2,1 2,1 88 1 2 2 1 1 2 1 2
398 1 11 2 6 3 3 1 1 2 2 5 7000 1400 4 2 2 2 2 2 2 2 2 99 99 1.35 30 26.1 2 6,6 6,6 99 2 99 2 4 3 1 88 nil 3 nil 88 1 1 1 1 2 2 1 2
399 1 13 1 8 3 3 0 0 2 2 7 10000 1428 4 2 2 2 2 2 2 2 2 99 99 1.52 45 57.1 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 2 1 2 4 2 1 2
400 1 14 1 8 1 2 1 1 2 2 5 7000 1400 4 2 2 2 2 2 2 2 2 99 99 1.48 50 84.6 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 3 nil 88 1 1 2 1 4 1 1 2
401 1 13 2 8 1 3 3 3 2 2 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.45 43 66.8 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 4,1 88 1 1 1 1 2 1 2
402 1 14 2 8 1 1 3 3 2 2 6 10000 1666 4 2 2 2 2 2 2 2 2 99 99 1.5 49 74.7 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 4,1 88 1 1 1 1 2 1 2
403 1 13 2 8 1 1 2 2 2 2 6 10000 1666 4 2 2 2 2 2 2 2 2 99 99 1.47 47 77.4 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 3,1 88 1 1 1 4 2 1 2
404 1 13 1 8 1 3 1 1 2 1 4 8000 2000 3 2 2 2 2 2 2 2 2 99 99 1.52 50 80.3 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 1 1 1 1 2 1 2
405 1 14 1 8 1 3 2 2 2 1 6 6000 1200 4 2 2 2 2 2 2 2 2 99 99 1.57 51 66.9 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 5,1 88 1 2 2 2 4 2 1 2
406 1 13 1 8 1 3 3 3 2 1 4 7000 1750 4 2 2 2 2 2 2 2 1 1 99 1.49 40 39.4 2 6,24 6,24 1 1 1 2 1 2 1 88 nil 1 nil 88 1 2 1 1 2 1 2
407 1 13 1 8 1 2 3 3 2 1 5 9000 1800 4 2 2 2 2 2 2 2 2 99 99 1.52 54 90.6 3 6,6 6,6 99 2 99 2 4 1 1 88 nil 3 nil 88 1 1 2 1 1 2 1 2
408 1 13 2 8 1 2 1 1 2 1 4 5000 1250 4 2 2 2 2 2 2 2 2 99 99 1.48 48 80.9 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 4 nil 88 1 2 1 1 4 2 1 2
409 1 12 1 8 1 3 3 3 2 2 5 5000 1000 4 2 2 2 2 2 2 2 2 99 99 1.5 51 89.7 3 6,6 6,6 99 2 99 2 4 2 1 88 nil 2,1 88 1 1 1 1 1 2 2 2
410 1 13 2 8 1 3 2 2 2 2 5 8000 1600 4 2 2 2 2 2 2 2 2 99 99 1.48 45 69.3 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 1,1 88 1 1 2 2 3 2 1 1
411 1 13 2 8 1 3 2 2 2 2 6 7000 1166 4 2 2 2 2 2 2 2 2 99 99 1.5 47 71.5 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 4 nil 88 1 1 1 1 2 1 2
412 1 13 1 8 1 3 3 3 2 1 3 6000 2000 3 2 2 2 2 2 2 2 2 99 99 1.52 49 78.7 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 3 nil 88 1 1 2 1 4 2 1 2
413 1 13 1 8 1 3 1 1 2 1 5 8000 1600 4 2 2 2 2 2 2 2 2 99 99 1.5 50 86 3 6,6 6,6 99 2 99 2 4 1 1 1 1 1 1 1 1 2 1 1 2 1 2
414 1 13 1 8 1 2 2 2 2 2 7 9000 1285 4 2 2 2 2 2 2 2 1 1 99 1.5 49 83.5 2 6,24 6,24 1 1 1 2 4 1 1 88 nil 2,1 88 1 1 2 1 1 2 1 2
415 1 13 1 8 1 3 3 3 2 1 4 6000 1500 4 2 2 2 2 2 2 2 1 2 5 1.48 52 91.6 3 6,18 6,18 2 1 1 2 4 1 1 88 nil 3 nil 88 1 1 1 1 2 2 1 2
416 1 12 1 8 1 3 2 2 2 2 6 8000 1333 4 2 2 2 2 2 2 2 2 99 99 1.55 47 69.8 2 6,6 6,6 99 2 99 2 4 1 1 1 1 3,1 88 1 2 1 1 2 1 2
417 1 13 2 8 1 2 2 2 2 3 7 10000 1428 4 2 2 2 2 2 2 2 2 99 99 1.45 40 48.8 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 2 nil 88 1 2 1 1 2 2 1 2
418 1 13 2 8 1 3 2 2 2 1 4 5000 1250 4 2 2 2 2 2 2 2 2 99 99 1.5 42 42 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 1 nil 88 1 1 2 1 1 2 1 2
419 1 13 1 8 1 2 3 3 2 2 5 8000 1600 4 2 2 2 2 2 2 2 2 99 99 1.48 48 82.2 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 2 nil 88 1 2 1 1 1 2 1 2
420 1 13 2 8 1 3 3 3 2 2 6 6000 1000 4 2 2 2 2 2 2 2 2 99 99 1.46 49 84.1 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 3 nil 88 1 1 2 1 2 2 1 2
421 1 12 1 8 1 2 1 1 2 2 7 8000 1142 4 2 2 2 2 2 2 2 2 99 99 1.55 51 83.9 2 6,6 6,6 99 2 99 2 4 2 1 88 nil 2 nil 88 1 1 1 1 2 1 2
422 1 13 1 8 1 3 2 2 2 1 4 9000 2250 3 2 2 2 2 2 2 2 2 99 99 1.51 45 66.2 2 6,6 6,6 99 2 99 2 4 1 1 88 nil 1 nil 88 1 1 1 2 2 1 2

ANNEXURE 9

A study on prevalence of refractive error
BY 20125002 M.D. COMMUNITY MEDICINE MEGALA. M

A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI DISTRICT, TAMILNADU- 2015

INTRODUCTION

"Eyes are the most precious of our sense organs. They contribute greatly to one's learning capacities right from childhood. Good vision contributes greatly to the strength of health and wits. The ultimate moulding of a person's personality and potentiality rests with his nature, surroundings and quality of eye sight."

Many ocular diseases have their origin in childhood and the morbidity may go unnoticed and adversely affect the child's performance in school and may also cause severe ocular disability in the later part of life. In school children, vision screening should be done very effectively to detect refractive errors, the correctable cause of decreased vision. It also helps in minimizing the long-term visual disability. In developing countries, children in the school-going age group represent 25% of the population.

"Every sixth child in the world lives in India according to the statistics by Ministry of Statistics and Programme Implementation- 2012.

In refractive error, optical system of the eye fails to adjust to bring parallel rays of light to focus on fovea. Uncorrected refractive error leads to reduced vision, thereby it becomes

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File size:	179.91K
Page count:	87
Word count:	13,387
Character count:	74,250
Submission date:	28-Sep-2015 10:55AM
Submission ID:	575812576

A STUDY ON PREVALENCE OF REFRACTIVE ERROR AND ITS
ASSOCIATED FACTORS AMONG SCHOOL CHILDREN IN KRISHNAGIRI
DISTRICT, TAMILNADU- 2015

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Many ocular diseases have their origin in childhood and the morbidity may go unnoticed and adversely affect the child's performance in school and may also cause severe ocular disability in the later part of life. In school children, vision screening should be done very effectively to detect refractive errors, the correctable cause of decreased vision. It also helps in minimizing the long-term visual disability. In developing countries, children in the school-going age group represent 25% of the population. [1] Every sixth child in the world lives in India according to the statistics by Ministry of Statistics and Programme Implementation- 2012.

In refractive error, optical system of the eye fails to adjust to bring parallel rays of light to focus on fovea. Uncorrected refractive error leads to reduced vision; thereby it becomes a major public health problem in school children in India. Cataract is the major cause of blindness in India followed by refractive error. Refractive error is the commonest condition, seeking attention at ophthalmology outpatient department[2][3] Poor vision

ANNEXURE 10

ETHICAL COMMITTEE APPROVAL

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
Telephone No. 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr.M.Megala
Postgraduate M.D.(Community Medicine)
Madras Medical College
Chennai 600 003

Dear Dr.M.Megala,

The Institutional Ethics Committee has considered your request and approved your study titled **"A study on prevalence of Refractive error and its associated factors among school children in Krishnagiri District, Tami Nadu – 2015"** No.06042015.

The following members of Ethics Committee were present in the meeting held on 07.04.2015 conducted at Madras Medical College, Chennai-3.

1. Prof.C.Rajendran, M.D.,   : Chairperson
2. Prof.R.Vimala, M.D., Dean, MMC, Ch-3   : Deputy Chairperson
3. Prof.B.Kalaiselvi, M.D., Vice-Principal, MMC, Ch-3   : Member Secretary
4. Prof.B.Vasanthi, M.D., Prof. of Pharmacology, MMC   : Member
5. Prof.P.Ragumani, M.S., Professor of Surgery, MMC   : Member
6. Prof.S.Baby Vasumathi, Director, Inst. Of O&G, MMC   : Member
7. Prof.K.Ramadevi, Director, Inst.of Biochemistry, MMC   : Member
8. Prof.Saraswathy, M.D., Director, Pathology, MMC, Ch-3   : Member
9. Prof.K.Srinivasagalu, M.D.,Director, I.I.M. MMC, Ch-3   : Member
10. Thiru S.Rameshkumar, B.Com., MBA   : Lay Person
11. Thiru S.Govindasamy, B.A., B.L.,   : Lawyer
12. Tmt.Arnold Saulina, M.A., MSW.,   : Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

ANNEXURE 11

PERMISSION LETTERS FROM SCHOOLS

From

The Director,

Institute of Community Medicine,

Madras Medical College,

Chennai - 600003.

To

The District Elementary Educational Officer,

BRC campus,

TNHB,

Krishnagiri- 635001

Through proper channel,

Respected Sir/Madam,

Sub: Request for permission to conduct a study in schools- Reg.

***

As Dr. Megala. M, II year M.D. Community Medicine student in Institute of Community Medicine, Madras Medical College, Chennai has planned to do a study titled ""**A study on prevalence of Refractive error and its associated factors among school children in Krishnagiri district, Tamil Nadu – 2015**", I humbly request you to grant her permission for undertaking the study and provide her with the list of schools.

Thanking you,

Date:
Chennai.

Encl: Details of study work

Yours sincerely,

Institute of Community Medicine
Madras Medical College & RGGGH
Chennai-600 003

Permitted to conduct the study in any two schools in Krishnagiri block in Krishnagiri District.

18/03/2015

Dist. Ele. Educational Officer
KRISHNAGIRI-635 001

9750982536

To

The Director,

Institute of Community medicine,

Madras Medical College,

Chennai-600003.

Dear Sir/Madam,

As a practising optometrist, I have assisted Dr Megala M, 2nd year student, MD Community medicine In Institute of Community Medicine, Madras Medical College, Chennai in her study on the title

" A Study on Prevalence of Refractive error and its associated factors among school Children in Krishnagiri District, Tamilnadu 2015"

Thanking you,

M. Murali 2/7/15

M. MURALI, B.Sc.,Opt.
Consultant Optometrists
(I.O.A)=L.M-02259/015 (DELHI)
Karimangalam-635 111.

To,

The Director,

Institute of Community Medicine,

Madras Medical College,

Chennai-600 003.

Dear Sir/Madam,

Sub: permission to conduct a study in school-Reg.

This is to inform you that **Dr. Megala. M,** II year M.D Community Medicine student in Institute of Community Medicine, Madras College, Chennai is granted permission to do a study in our school on the title "A study on prevalence of Refractive error and its associated factors among school children in Krishnagiri Dt", TamilNadu-2015.

Thanking you,

Yours sincerely

PRINCIPAL
SVC Matric. Hr. Sec. School
Marikkampalli-Village
ITTIKKAL AGARAM-Po, 635122
Krishnagiri-Dist.

CAMBRIDGE PUBLIC *e* - SCHOOL

Affiliated to CBSE, New Delhi. No : 1930426

Kakkangarai Road,
Kaveripattinam - 635 112,
Krishnagiri District, TN.
Phone : 04343 - 250526
Mobile : +91 99656 81811
www.cambridgecauvery.com
email : cambridgekvptm@gmail.com

June 16, 2015.

To

The Director,

Institute of Community Medicine,

Madras Medical College,

Chennai. 600 003.

Dear Sir / Madam,

Sub: Permission to conduct a study in school – Reg.

This is to inform you that Dr. Megala. M, II year M.D Community Medicine student in Institute of Community Medicine, Madras Medical College, Chennai is granted permission to do a study in our school on the title "A study on prevalence of Refractive error and its associated factors among school children in Krishnagiri Dt, Tamilnadu – 2015.

Thanking you,

Yours sincerely,

PRINCIPAL
Cambridge Public e-School
KAKKANKARAI ROAD
KAVERIPATTINAM-635112

Date: 16 June 2015