Ametropia among students in the Kuala Belait district of Brunei Darussalam

Sui Lian ON [1], Azimuddin Azim SIRAJ [1], Nayan JOSHI [2], Zakir Mohammed HOSSAIN [1], Nadir Ali Mohamed ALI [2], Imripan FRANCIS [2]
[1] Department of Ophthalmology, Suri Seri Begawan Hospital, Kuala Belait and
[2] Department of Ophthalmology, RIPAS Hospital, Bandar Seri Begawan, Brunei Darussalam

ABSTRACT

Introduction: Uncorrected ametropia is one of the primary causes of visual impairment in children worldwide. It is potentially correctable but requires early detection. This study aims to determine the prevalence of ametropia among students aged between five and 17 years in the Kuala Belait district, Brunei Darussalam. **Material and Methods:** A survey of all school students in the district was done by School Health Services (SHS) nurses in a period of three years. An unaided visual acuity of 6/12 (20/40) or worse in one or both eyes was used as a cut-off point for referral to hospital optometrist. Retinoscopy, automated and subjective refraction, fundus evaluation and appropriate specialist referrals were performed for all referred children in the Eye Clinic of the Suri Seri Begawan Hospital, Kuala Belait District. **Results**: A total of 8,623 children were examined by SHS nurses. Out of those, 177 (2.06%) fulfilling the criteria for referral were identified and referred. Among referred children, Malay ethnicity was the commonest (76.3%) followed by Chinese (19.8%). Females out-numbered males (97:80). Simple Myopic-Astigmatism was the commonest refractive error encountered (46.89%) followed by Simple Myopia (17.5%), hypermetropic astigmatism (11.9%) and pure astigmatism (7.9%). The least common refractive error was hypermetropia (2.3%). Amblyopia was evident in only three children (1.7%). **Conclusion:** The prevalence of refractive errors among primary and secondary students in the Kuala Belait is 2.1%, and the most common refractive error was simple myopic astigmatism. This study reflects the need for continuous and regular School Health Service eye screening in order to detect those students who may suffer from significant refractive errors.

Keywords: Amblyopia ametropia, astigmatism, children, hypermetropia, myopia

INTRODUCTION

Uncorrected ametropia accounts for half the causes of avoidable visual impairment, nearly a third of the avoidable blindness, and one of the primary causes of visual impairment in children worldwide. [1, 2] In this regard, the World Health Organisation (WHO) launched a global initiative, Vision 2020 - The Right to Sight, to eliminate avoidable blindness among children and to prevent the projected dou-

Correspondence author: Sui Lian ON
Department of Ophthalmology, Suri Seri Begawan Hospital, Kuala Belait, Brunei Darussalam
Tel: +673 885 4138
Fax: +673 333 3159
E mail: suilianon@moh.gov.bn

bling of avoidable visual impairment between 1990 and 2020. [3, 4] High myopia (short-sightedness) is associated with potentially blinding conditions such as retinal detachment, macular degeneration, cataract and glaucoma, and delay in treating any refractive errors can lead to amblyopia (lazy eyes). [5-7]

The prevalence of refractive errors in primary school students varies globally, from 1% in rural Tanzania to 8.1% in Kathmandu, 14.8% in Malaysia, 36.7% in Hong Kong, and more than 50% in Singapore. [8] A prevalence of more than 80% was found in students aged 18 in Taiwan. [9] The wide variations of reported prevalence of refractive error could be attributed to several factors, including the targeted study population (population-based or school-based), methods of measurement (cycloplegic or non-cycloplegic), ethnicity and definition of terms such as the degree of myopia, hypermetropia and astigmatism. [10]

Brunei Darussalam has committed to join the WHO Vision 2020 campaign. [11, 12] There has been no reported studies in this regard from Brunei Darussalam. These studies provide some insight into the current regional prevalence and load of refractive errors among primary school students in Brunei Darussalam and could possibly help in planning and strategising a national level programme.

MATERIALS AND METHODS

Study Design and Duration: A school-based cohort study was performed from January 2009 to December 2011, in which school students studying from Kindergarten to Year 11 from the 34 schools in the Kuala Belait district were screened for refractive errors as part of a Ministry of Health Initiative.

Setting: Brunei Darussalam has a total population of 414,400 (2010 population census) is divided into four administrative districts, namely Brunei Muara, Kuala Belait, Tutong and Temburong. Among these four districts, Kuala Belait remained the largest with an area of 2,724 square kilometres and a population density of 68,300. It was also recorded that Kuala Belait district had a population density of 25 persons per square kilometres and a 1,161 male per 1,000 female ratio (Brunei Darussalam Statistical Yearbook 2010, Department of Statistics, Department of Economic Planning and Development (JPKE) Prime Minister's Office) with 36,700 males and 31,600 females recorded, in which 35,200 were Malays, 14,300 were Chinese and 18,800 were others. Vision screening was free for all school students.

Inclusion and exclusion criteria: School students aged between five and 17 years old, whose parents had granted informed consent were included in the study. The study was carried at each participating school. Exclusion criteria included those not willing to participate and those with other ocular pathologies. All students will be screened once within the period of the study. No repetition of data was allowed.

Ethical issues: Appropriate approvals for this study were obtained from the administrative authorities, Medical and Health Research and Ethics Committee (MHREC), and also principals and parents of school students from all the participating schools.

Methods (method of surveying, criteria for referral and data collection): Unaided vision/visual acuity was assessed in each eye

by the SHS nurse during school health visits. A standard Snellen visual acuity chart was used and monocular vision was tested at a standard distance of 6 meters. Unaided visual acuity of 6/12 (20/40) or worse in one or both eyes was used as SHS cut-off point for referral to the optometrist at Suri Seri Begawan Hospital (SSBH). A referral form was issued by the SHS nurse during the referrals to SSBH, the only secondary care provider in the Kuala Belait district.

A total of 8,623 school students from 34 schools in the Kuala Belait District (24 Government schools and 10 private schools) were screened. A total of 177 school students were referred to the Eye Clinic, SSBH during the three-year period. In the hospital, monocular vision was first recorded by the Ophthalmic Assistant (OA). Auto Projector Chart (Topcon Corporation, Japan) was used and visual acuity was measured at six metres. Pin Hole vision (PH) was recorded to assess for any possible improvement in vision. Sheridan Gardiner (Keeler, UK) test charts were used for very young students. Monocular near vision was recorded using Clement Clarke Vocational Near Vision Test Type. The optometrist would refract the child with automated auto refractor Kowa KW-2000 Auto Refkeratometer Japan or UK) and manual professional streak retinoscope (Keeler Corporation, UK). Subjective refraction was done with a phoropter (Shin-Nippon Corporation, Japan) or with trial lenses put in trial frame based on patient preference. Slit lamp anterior segment evaluation (Shin-Nippon Corporation, Japan) and standard direct ophthalmoscopic evaluation (Medic Lux, Keeler Corporation, UK) was done to rule out organic causes of visual impairment. The existing spectacle powers were assessed by an automated Lens-(Huvitz HLM-7000, Republic of Korea).

Cyclomydril (Alcon laboratories, USA) 5 ml consisting of 0.2% cyclopentolate hydrochloride, 1% phenylephrine hydrochloride was used for cycloplegia and was instilled every 10 minutes for three consecutive times. Parents or guardians of students were encouraged to sit in throughout the eye test. Convergence test was performed for all students with the RAF Near Point Rule (Clement Clarke Ltd, UK). Cover test was also performed to detect any binocular vision anomalies including latent or manifest squints.

If any ocular pathology was detected, the student was referred to the ophthalmologist for a detailed evaluation and advice. Binocular vision anomalies were referred to the orthoptist for further evaluation and advice.

A feedback letter was given to the SHS referral nurse for all students. Students who were prescribed glasses were reviewed after making their glasses to verify if the correct refractive power was incorporated. All students were reviewed the next year by the optometrist to ensure continuance of patient care. The contact numbers of all the students were maintained by the optometrist in the appointment book and the parents were contacted if the student had failed turn up for new spectacles verification appointment and ensure that he or she is in compliance with spectacle wear. [13]

In this study, Myopia was defined as refractive error of at least -0.50DS, Low myopia was defined when refractive error is from -0.50DS to -3.00DS, Medium or moderate

myopia from -3.00DS to -6.00DS and high myopia as -6.00DS onwards. [14] Simple myopic astigmatism was defined as an astigmatism associated refractive error from -0.50DS to -3.00DS, medium myopic astigmatism was defined as an astigmatism associated refractive error from above -3.00DS to -6.00DS and High myopic astigmatism as an astigmatism associated refractive error from above -6.00DS. [15] Hypermetropia was defined as refractive error of at least +0.50DS, Low Hypermetropia above +0.50DS to +3.00DS, medium hypermetropia from above +3.00DS to +5.00DS and high hypermetropia above +5.00DS. [16] Emmetropia was defined as a spherical equivalent between -0.50DS and +0.50DS. [17] Pure astigmatism was defined as mild from 0.25D to 0.75D, as moderate from1.00D to 2.50D, as severe from 2.75D to 4.75D and as extreme if 5.00D or higher. [18]

Data Analysis: Data was collected and entered into Excel worksheet for analyses. Prevalence percentage was calculated for each group.

RESULTS

There were a total of 8,623 students were screened. The demographic distribution of the students is shown in Table 1. (*For the breakdown of participating schools, refer to Supplementary Text).*

Of the students screened, 177 (2.05%) were referred to the optometrist with visual acuity of 6/12 or less due to refractive errors, giving an overall prevalence of refractive errors of 2.05% among school-age children in Kuala Belait District, Brunei Darussalam. The prevalence was higher in females compared to male students. Table 2 shows the breakdown of refractive abnormalities by ethnicities and gender.

Table 1: Demographic of subjects.

Student demographics	**N (%)**
Gender	
Males (Malay)	3,697 (55.02)
Females (Malay)	3,022 (44.98)
Total Malays	6,719 (77.92)
Males (Chinese)	613 (51.91)
Females (Chinese)	568 (48.09)
Total Chinese	1,181 (13.70)
Males (Ibans)	309 (55.38)
Females (Ibans)	249 (44.62)
Total Ibans	558 (6.47)
Males (Indians)	49 (51.04)
Females (Indians)	47 (48.96)
Total Indians	96 (1.11)
Males (Filipino)	22 (32.35)
Females (Filipino)	46 (67.65)
Total Filipinos	68 (0.79)
Males (Sri Lankan)	0
Females (Sri Lankan)	1(0.01)
Total Sri Lankan	1 (0.01)
Total male students	4,690 (54.39)
Total female students	3,933 (45.61)
Median Age (years)	9.97
Range	5 - 17

Simple myopic-astigmatism was most prevalent among the Chinese (1.86%), fol-

Table 2: Breakdown of students with refractive errors by ethnicities and genders.

Race	**Male (N= 4,690) n (%)**	**Female (N=3,933) n (%)**
Malay	58 (1.24)	75 (1.91)
Chinese	19 (0.41)	16 (0.41
Iban	3 (0.06)	5 (0.13)
Indians	0 (0)	1 (0.03)
Others	0 (0)	0 (0)
Total	80 (1.59)	97 (2.49)

Table 3: Ethnic and gender prevalence of ametropia (January 2009 to December 2011).

Refractive error	Malay Male	Malay Female	Chinese Male	Chinese Female	Iban Male	Iban Female	Indian Male	Indian Female	Others Male	Others Female	Total n (%)
Simple myopia	13	11	2	3	0	1	0	1	0	0	31 (0.36)
Myopic astigmatism	33	45	11	11	3	3	0	0	0	0	106 (1.23)
Simple	28	33	8	9	3	2	0	0	0	0	83 (0.96)
Medium	3	8	3	1	0	1	0	0	0	0	16 (0.19)
High	2	4	0	1	0	0	0	0	0	0	7 (0.08)
Simple Hypermetropia	1	2	1	0	0	0	0	0	0	0	4 (0.05)
Hypermetropia astigmatism	8	9	2	2	0	1	0	0	0	0	22 (0.26)
Low	8	9	2	2	0	0	0	0	0	0	21 (0.24)
Medium	0	0	0	0	0	1	0	0	0	0	1 (0.02)
High	0	0	0	0	0	0	0	0	0	0	0 (0)
Pure astigmatism	3	8	3	0	0	0	0	0	0	0	14 (0.17)
Mild	0	4	2	0	0	0	0	0	0	0	6 (0.07)
Moderate	3	0	0	0	0	0	0	0	0	0	3 (0.03)
Severe	0	3	1	0	0	0	0	0	0	0	4 (0.05)
Extremely high	0	1	0	0	0	0	0	0	0	0	1 (0.02)
Subtotal	58	75	19	16	3	5	0	1	0	0	
Total	133		35		8		1		0	0	177

(%) is out of the total number of students examined (N=8,623)

lowed the Malays (0.91%) and the Ibans (0.9%). The second most prevalent refractive error was simple myopia, which was also highest among the Chinese (0.42%), followed by the Malays (0.37%) and the Ibans (0.18%). Medium hypermetropic astigmatism was the third most prevalent refractive errors found highest among the Chinese (0.34%) followed by Malays 0.26% and Ibans with 0.18%. Pure Astigmatism was the fourth most prevalent refractive error found among Chinese (0.26%) followed by Malay (0.17%). Simple hypermetropia was found to be the lowest prevalence refractive error in Chinese (0.09%) and in Malays (0.05%) (Table 3).

DISCUSSION

Our study showed the overall refractive error was 2.05%; higher in female (n=97/3,933, 2.47%) compared to male (n=80/4,690, 1.71%). According to the Brunei Darussalam Statistical Yearbook 2010, the ratio of male to female in the Kuala Belait district was 36,700/31,600 = 1.16 and our study sample of male to female students in the same district was 4,690/3,933= 1.19, indicating that our study sample was almost an exact true representation of the population sample in the district (also more male than female ratio).

In our study, myopic astigmatism was most common among the Chinese (2.29%), in contrary to similar studies from Malaysia and Singapore which have reported that simple myopia was the most common refractive error among school-aged Chinese population, 30.9% and 40.1% respectively. [19, 20] This provided an insight into the load of refractive errors, which might have gone unnoticed if not screened by the SHS leading to potential visual complications including amblyopia. The prevalence rate of a significant refractive error

of 2.06% in our study is lower than studies done in most countries. [21-24]

Uncorrected high myopic–astigmatism can lead to very poor vision possibly resulting in amblyopia. [25] Pathological or very high myopic-astigmatism can lead to retinal detachment, macular degeneration, cataract and glaucoma. [26] Hence there is a need for their prompt and early detection to avoid possible long term and irreversible sequelae. Those with progressive or myopia creep would need closer monitoring. However in our study, no ocular pathologies due to high myopia were seen. Any uncorrected or under corrected refractive errors could have serious impacts on school students affecting their school performance. [27] Teachers or fellow students who are unaware of the child's visual debility could falsely accuse them of laziness or indifference towards studies. Therefore, it is essential to detect ametropia early. All students and parents were explained clearly about the importance of spectacle wearing if found to have significant uncorrected ametropia.

To prevent spectacle wear intolerance, partial spectacles corrections were prescribed to children with high refractive errors. This approach was described previously by Edwards *et al*. [28]

Students' visual demand is increasing in today's modern education system. They have to do more and more vision demanding tasks at an early age. Stimulus deprivation conditions like refractive errors that are not treated in time might lead to amblyopia which could cause irreversible vision loss if not detected and treated early. Amblyopia could be prevented simply by appropriate optical corrections. [29]

This study illustrates the need to continue screening young children and teenagers regularly as it has been found that out of the 177 referred students, only 40 of them were aware of their refractive error. If the other students were not referred on time, there could have been irreversible visual impairment and possible implications in the child's learning and social outlook.

These emphasize that screening in school and pre-school ages should continually be carried out periodically. It is equally important to educate the students and parents regarding spectacle wear compliance and coming for follow-ups.

The sample of 8,623 (students) screened were representing a regional spectrum of refractive errors in the Kuala Belait district but not the whole country. A larger, multi-centre sample could provide a better nation-wide perspective. This study did not take into account the dropouts who did not come to the hospital for evaluation. However, the school health services nurses also maintained a list of students referred to the eye clinic and the students who missed the appointments were later recalled. Cycloplegic refraction could not be done on all students with hypermetropia. This could imply some possible overcorrection.

In conclusion, the slightly higher prevalence rates of myopic-astigmatism in the Kuala Belait district could be attributed to the ethnic distribution of the local population, a possible hereditary predisposition of the Asian population and intense schooling work-loads

like prolonged hours of near work, tuitions after school and doing a lot of visual demanding tasks such as computer works or games. [30, 31] A bigger, multi-centre and nationwide study is recommended.

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