

# Prevalence and associated risk factors for childhood strabismus in Lhasa, Tibet, China: a cross-sectional, school-based study

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## Research article

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# Abstract

## Background

To estimate the prevalence of strabismus and associated risk factors among grade one school children in Lhasa, Tibet, China.

## Methods

The Lhasa Childhood Eye Study (LCES) was a cross-sectional, school-based childhood study conducted in Grade one students from primary schools in Lhasa, Tibet, China. Comprehensive ophthalmic examinations and basic systematic examinations were evaluated. A questionnaire survey contained information about children, as well as parents' information was sent to the corresponding parents of eligible children. The prevalence of strabismus and its 95% confidence interval was estimated. Univariate and multivariate logistic regression analyses were conducted to determine the associated risk factors.

## Results

A total of 1942 eligible grade one students were enrolled, of which 1856 participants completed all procedures. The average age was  $6.83 \pm 0.46$  years, 53% of participants were boys and 1762 were the Tibetan Minority. Overall, the prevalence of strabismus was 68/1856(3.7%) (95%CI: 2.81,4.52), with no difference between the ages, genders, ethnics and BMI, while tilt one's head when writing was a risk factor for strabismus ( $P=0.004$ ). Strabismus students had the mean best corrected visual acuity  $0.16 \pm 0.28$ (LogMAR), over 50% patients with esotropia are hyperopia, participants who has stereopsis impairments showed a significant difference between esotropia and exotropia ( $P = 0.026$ ).

## Conclusions

The prevalence of strabismus in LCES was 3.7%, higher than previous reports from Chinese childhood epidemiology studies. Strabismus is a common contributing factor to amblyopia. Tilt one's head when writing was a risk factor. Patients with esotropia are more likely to affect stereopsis and be the refractive state of hyperopia.

## Trial registration:

The study has finished the clinical registration on Chinese Clinical Trial Registry. (<http://www.chictr.org.cn>, ChiCTR1900026693).

## Background

Strabismus, also called squint, is a condition of misalignment of the visual axes of the eyes, was first known as eye misalignment since the Hippocratic era.<sup>1</sup> It can adversely affect not only binocular single vision, like simultaneous perception, fusion and stereopsis, but also cosmetic impairment, which would cause significant psychosocial consequences.<sup>2, 3</sup> Strabismus is a common contributing factor to amblyopia in children, which will persist into adulthood if not treated in time.<sup>4</sup> Hence, early detection and treatment should be considered of strabismus and amblyopia, especially in preschool children, to maximize binocular potential and to improve outcomes.<sup>5, 6</sup>

An accurate epidemiology of disease will help in evaluating the screening results, improving effective treatment strategies and guiding the allocation of medical resources.<sup>7</sup> However, although the prevalence of strabismus in school-based studies have been estimated these years, the prevalence of various studies differs, and screening for eye diseases in school-aged children was always done in large cities, very few information is available in remote areas, like Tibet at such high-altitude plateau area. Impaired vision in early childhood can have a profound impact on a child's development, screening for childhood has become an important part of the children's eye health program and should be done urgently.<sup>8, 9</sup>

Tibet is a region in Asia covering much of the Tibetan Plateau, with an average elevation of 5,000 m. The atmospheric conditions are hypobaric, with thin air, high numbers of sunshine hours and strong ultraviolet radiation.<sup>10</sup> To our knowledge, although some epidemiological surveys of common eye diseases have been carried out these years, it lacks of longitudinal investigation on eye diseases of school-age children in the Tibetan plateau areas.<sup>11</sup> The purpose of this survey was to assess the prevalence and progressive of strabismus in native Tibetan children, to determine its associated risk factors and to evaluate the demand for eye care service in Lhasa Prefecture, Tibet Autonomous Region, China.

## Methods

### Study design

The Lhasa Childhood Eye Study (LCES) was a cross-sectional, school-based, longitudinal cohort study conducted in Lhasa, Tibet, China. The study was mainly designed to estimate the prevalence and associated risk factors of ocular diseases in school-age Children during 5-year follow-up (Chinese Clinical Trial Registry [ChiCTR], Identifier: ChiCTR1900026693). Ethics committee approval was obtained from the Institutional Review Board of Beijing Tongren Hospital, Capital Medical University (TRECKY2019-146) in accordance with the Declaration of Helsinki principles. The first visit of LCES is between September 2019 to October 2019. Written informed consent forms were obtained and signed by all parents or guardians before the examinations. The procedures were modified from the Anyang childhood eye Study (ACES) conducted in central China.<sup>12</sup>

### Participants

There are totally 28 elementary schools in Lhasa. Officials from the health and the education departments of Lhasa summoned the principals of the 28 schools before the recruitment, to inform them the LCES would be conducted from 2019 to 2024. 27 out of the 28 elementary schools in Lhasa were available to join and were stratified into three levels based on the evaluation of local government. Voluntary Grade one students who have been living in Lhasa city for at least half a year and will continue to live there for at least 5 years until they enter different middle schools are included in LCES. Individuals suffering from mental illness or other medical conditions that are unable to cooperate with the baseline survey will be excluded. According to geographical characteristics and required sample size, 1943 Grade one students of 7 primary schools were randomly sampled by stratified cluster sampling, all the clusters were numbered according to their locations and were randomly selected using a random numbers table. Participants will be followed 5 years until they enter different middle schools and could withdraw from the study anytime for any reason.

### **Parental questionnaire**

The questionnaires were mainly derived from the version of that used in the ACES12 and were modified to make sure the questionnaires culturally appropriate and linguistically accurate. The questionnaire contained information about indoor and outdoor activity, history of the birth and ophthalmic treatment, and habits of reading, writing, living, eating and so on, as well as parents' information such as refractive and socioeconomic status, education, pregnancy history, medical records and many aspects. For example, the questionnaire would ask 1)'What is your child current preferred writing posture?' and 2)'As far as you remember, did your child prefer to tilt his head when he/she was writing?' with the following options: Yes or NO or Not sure.

### **Procedures**

#### **Systematic examinations:**

Blood pressure and heart rate were measured using a digital automatic blood pressure monitor (HK-808, HSH, Shenzhen, China). Oxygen saturation was measured using a digital fingertip pulse oximeter (YX301, YUWELL, Jiangsu, China). Height and weight (without shoes or heavy clothing) will be determined using a weighing scale. Body Mass Index (BMI,  $BMI = \text{weight}/\text{height}^2 \text{ kg}/\text{m}^2$ ) was also calculated.

#### **Ophthalmic examinations:**

The comprehensive eye examination was performed by a team of two optometrists and four ophthalmologists from Beijing Tongren Hospital who were trained and certified using standardized study protocols.

**Distant and near visual acuity:** Uncorrected and presenting distant visual acuity (VA) were measured for the right eye and left eye using Lea Symbols ETDRS 3 meter Set charts (250300, Goodlite, IL, USA) at a distance of 3 meters based on the instructions and standard procedure. The last line attempted, combined with the number of mistakes made on that and previous lines, is used to calculate a letter-by-

letter logMAR VA score. Pinhole and best-corrected distant VA (BCVA) were obtained after subjective refraction test for students with uncorrected distance VA 20/20 (LogMAR 0).

**Refraction:** Objective refraction was measured before and after cycloplegia using an autorefractor (KR-800, Topcon, Tokyo, Japan). The cycloplegic procedure for each student was first administered one drop of topical anesthetic agent (Alcaine, Alcon), followed by two drops of 1% cyclopentolate (Alcon) and one drop of Mydrin P (Santen, Japan) given 5 minutes separately. 30 minutes after the last drop is instilled, a third drop of cyclopentolate would be administered if pupillary light reflex was still present or the pupil size was less than 6.0 mm.

**Ocular movements:** Nine directions of gaze including primary, secondary and tertiary were examined and recorded by asking students fixating on a moving penlight without moving their heads.

**Ocular dominance:** Students were asked to hold a card with a central hole and fixate on a distant object while holding their head stationary. The examiner covered the students' eyes one after the other and repeated three times to determine the ocular dominance eyes.

**Cover test:** Unilateral and alternating cover tests were performed at far (6 m) and near (33 cm) to detect tropia and phoria by an experienced pediatric ophthalmologist under the natural condition (with and without spectacles), respectively, and the magnitude of the deviation was measured using loose prism. The prism was placed with the base along the reversed direction of deviation and was adjusted until no movement could be detected.

**Stereopsis:** Stereo Fly Test (S0001, STEREO, USA) was used to quantitatively measure stereoacuity for students at 40 cm.

### **Diseases Definition and classification**

Strabismus was defined if any tropia was present at near or distance, with or without spectacles and then classified according to the primary direction of the tropia.<sup>13</sup>

Depending upon the clinic-etiological features, primary exotropia was classified into basic non-specific type (exotropia approximately equal for near and distance), convergence insufficiency type (exotropia greater for near than distance,  $\geq 10$  prism diopters [PD]), and divergence excess (exotropia greater for distance than near,  $\geq 10$  PD). Esotropia was classified into accommodative esotropia (due to overaction of convergence associated with accommodation reflex) and non-accommodative esotropia (all those primary esodeviations in which amount of deviation is not affected by the state of accommodation and equal in amount at distance and near fixation).<sup>14</sup>

Micro-strabismus was defined as a deviation of  $\geq 10$  PD in the presence of demonstrable binocular vision on the Lang II test. In the absence of demonstrable binocular vision, a deviation of this magnitude was classified simply as strabismus.<sup>15</sup>

## Statistical analysis

The prevalence of strabismus is calculated and analyzed as the percentile of the number of individuals with different types of strabismus to the total number of individuals evaluated. Continuous variables were given as the mean  $\pm$  standard deviation (SD), and categorical variables were given as the absolute value and relative frequency. Prevalence of strabismus and its 95% confidence interval (CI) was estimated using a general linear model. Risk factors associated with high level strabismus was evaluated using linear regression model. The potential risk factors including general characters like age, gender, ethnic, BMI, heart rate, oxygen saturation, and habits of reading, living, eating, as well as parents' information such as pregnancy history and so on. The analyses were implemented with SAS software version 9.4 (SAS institute Inc. Cary, NC).  $\chi^2$  tests and *t*-tests were also used. A p-value of  $<0.05$  was considered statistically significant.

## Results

### General Information

A total of 1942 Grade one student were enrolled, of which 1902 (97.94%) were eligible for LCES according to the inclusion and exclusion criteria. A subset of 1856 of the remaining eligible individuals completed all the procedures, giving a response rate of 97.58%. For the entire group of analyzable participants, 1762 (94.93%) students were the Tibetan Minority, 85 (4.58%) were Han Majority and 9 (0.49%) were other minority nationalities. The average age was  $6.83 \pm 0.46$  years and 984 (53.02%) of the participant were boys (Table 1). The mean BCVA measured by LogMAR of the eyes was  $0.05 \pm 0.11$  and  $0.05 \pm 0.10$  for right and left eye, respectively. Cycloplegic spherical equivalent (SE) was  $+1.07 \pm 0.92$  diopters (D) for right eye, 1192 (64.22%) of the participants' ocular dominance eyes were right eyes.

### Prevalence of strabismus

Based on the comprehensive eye examinations of the 1856 Grade one students, the overall prevalence of strabismus was 3.66% (95%CI, 2.81-4.52%), of the 68 students with strabismus, the most frequent form of strabismus was exotropia 43 (2.32%), followed by eight (0.43%) esotropia, with an exotropia: esotropia ratio of 5.38:1, two (0.11%) microtropia (one esotropia and one exotropia), eight (0.43%) vertical deviation combining horizontal strabismus, and seven (0.38%) had exotropia combining superior oblique muscle paralysis (SOP), one (0.05%) had exotropia combining double depressor paralysis (DDP) . Three cases (0.16%) with pure vertical strabismus, and all of these were SOP. Four (0.22%) special strabismus cases were diagnosed, two had Duane syndrome, one had dissociated vertical deviation (DVD) combining oblique muscle dysfunction and one had nystagmus for congenital cataract (Table 2). The magnitude of exotropia and esotropia were shown in Figure 1 and Figure 2. 11 students (16.18%) with strabismus also had amblyopia, eight (11.76%) of them were esotropia, two were exotropia and one was vertical deviation combining horizontal strabismus.

No significant difference of BCVA between collateral eyes ( $P=0.59$ ) for the entire group. The mean BCVA of the strabismus and non-strabismus had significant difference with  $0.16\pm 0.28$  and  $0.04\pm 0.09$  ( $P=0.00$ ). 40 with strabismus of 1192 participants' ocular dominance eyes were right eyes, 28 with strabismus of 664 ocular dominance eyes were left eyes, the effect of ocular dominance eyes was not statistically significant ( $P=0.34$ ) between strabismus and non-strabismus patients.

### **Risk factors related to strabismus**

Table 3 shows the risk factors associated with strabismus. Tilt one's head when writing ( $P=0.004$ ) had inverse relationships with the prevalence of strabismus. The odds of strabismus in incorrect writing posture was 1.58 (95% CI:1.16-2.15) times more than correct writing posture which refers to keeping head in a plane perpendicular to the ground. The effect of age, sex, ethnic were not statistically significant ( $P=0.05$ ). In multiple logistic regression for strabismus, writing posture was statistically significant in strabismus subjects (OR1.5; 95% CI, 1.07-2.08), showed a higher prevalence of strabismus with incorrect writing posture as tilt one's head when writing.

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### **Refractive status**

Among the 1856 Grade one students examined, 1853 (99.84%) had cycloplegic autorefraction performed on both eyes. The mean cycloplegic SE of two eyes for horizontal strabismus were  $+1.24 \pm 1.49D$  and  $+1.21 \pm 1.33D$ , with no significant difference ( $P=0.89$ ). The prevalence rates of emmetropia (between  $-0.50D$  and  $+2.00D$  in both eyes) were 89.15% based on right eyes obtaining data. The mean cycloplegic SE of esotropia students was  $+2.05D$  compared with  $+1.09D$  in exotropia students, the difference was statistically significant ( $P \leq 0.05$ ). Figure 3 illustrates the cycloplegic SE of esotropia and exotropia students.

### **Stereopsis**

Stereopsis acuity and deviation were evaluated in 49 esotropia and exotropia definite diagnosed participants. The mean deviation angle was  $35.00 \pm 17.80$  PD of 4 participants who loss of stereopsis vision, and the remaining 45 participants with stereopsis vision ( $\leq 3600$  seconds of arc) were  $33.00 \pm 11.40$ PD. Participants lack stereopsis vision had significantly larger prism diopters than those who have binocular vision ( $P \leq 0.05$ ). Participates with stereopsis impairment showed significant difference between esotropia (3/8) and exotropia (2/43) ( $P=0.026$ ), while esotropia was more likely to affect stereopsis.

## **Discussion**

To the best of our knowledge, the LCES is the first comprehensive school-based cohort study in high-altitude plateau Lhasa, Tibet, China and provide baseline data of Tibetan Minority for epidemiology of Grade one students eye disorders. We found the prevalence of strabismus was 3.66% with the exotropia: esotropia ratio was 5.38:1, and participants with esotropia are more likely to affect stereopsis and most of them were hyperopia. We will discuss the significant conclusions below.

The overall prevalence of strabismus in our study was higher than previously reports from China and most of other studies around the world. We summarized the previous prevalence of Chinese pediatric strabismus study in Table 4.3, 7, 16–23 However, the prevalence of strabismus in our study was lower than 5.65% and 5.8% in different 3-6-year-old Nanjing Pediatric study<sup>7, 18</sup>, while Nanjing is a metropolis in eastern China. Compared with the prevalence from other countries, prevalence of LCES 3.66% was higher than 3.3% in Caucasian and 2.1% African American children in the Baltimore Pediatric Eye Disease Study<sup>24</sup>, 2.4% in Hispanic/Latino and 2.5% African-American children in the Multi-Ethnic Pediatric Eye Disease Study<sup>25</sup>, and 1.3% in Japan<sup>26</sup>, 2.4% in Turkey<sup>27</sup>, 0.8% in the Strabismus, Amblyopia and Refractive Error in Singaporean Children (STARS)<sup>28</sup>.

The higher prevalence of strabismus in LCES may be related to several reasons. Firstly, among the 1856 participants, 94.93% were native Tibetan Minority, the potential ethnic, environmental, lifestyle and genetic susceptibility differences<sup>16</sup> are still unclear, Qian reported that the prevalence of ocular diseases differ in Tibet may be related to more exposure to sunlight and easier schooling,<sup>29</sup> whether Tibetan children had a higher prevalence of strabismus still remains to be investigated further. Secondly, different age ranges of the different studies may play an important role,<sup>3, 16</sup> the mean age of our voluntary students was  $6.83 \pm 0.46$  years, while the age range was narrower than others, however, older than the two Nanjing pediatric studies.<sup>7, 18</sup> Finally, we have recruited four professional strabismus and pediatric ophthalmologists to examine the participants, they have professional experience in checking strabismus, some unnoticed patients can also be detected. Considering the mentioned reasons above, we may explain the higher prevalence in LCES.

The ratio of exotropia: esotropia in LCES was 5.38:1, which was lower than many studies,<sup>3, 7, 16–23</sup> the reason for that probably related to the status of refraction, the distribution of the cycloplegic SE of esotropia in LCES tends to be hyperopia, which was consistent with the conclusion that exotropia was associated with astigmatism, myopia and low to moderate hyperopia, while esotropia was associated with hyperopia in a dose-response manner.<sup>16, 30, 31</sup> Qian also found that Tibetan adolescents had a lower prevalence of refractive errors than the plains (central China) area except hyperopia, which also suggested that the rate of hyperopia in Tibet is higher.<sup>29</sup> Compared with the prevalence of hyperopia was 2.21% in ACES, LCES was 6.91% ( $P < 0.05$ ), hence, the ratio of exotropia: esotropia between ACES and LCES was such a huge difference.

Strabismic amblyopia could lead to the domination of the fixating eye and chronically reduced responsiveness to input by the non-fixating eye.<sup>8</sup> The mean BCVA of the strabismus and non-strabismus showed students with strabismus had worse BCVA. We also found that participants with stereopsis impairment had bigger prism diopters and esotropia was more likely to affect stereopsis. Visual acuity of strabismic amblyopia can be improved after successful treatment in younger age and stereopsis can be restored after surgical alignment in many strabismus.<sup>32, 33</sup> The earlier that clinically significant refractive error and strabismus are detected and treated, the greater the likelihood of preventing amblyopia.<sup>8</sup> However, most children with strabismus and amblyopia in LCES have not been diagnosed before, let alone further treatment.

Some studies had found higher prevalence of strabismus in older students,<sup>3, 16</sup> our study did not find that for students in LCES from Grade one, the age span was not as large as others. The effect of some regional factors like oxygen saturation and ethnic characters were not statistically significant likewise, which is in agreement with the previous study.<sup>16</sup> Enough fruits and vegetables intake cannot reduce the prevalence of strabismus, either. Tilt one's head when writing was a risk factor for the prevalence of strabismus. In multiple logistic regression for strabismus forward, writing posture was statistically significant, reflecting a higher prevalence of strabismus with habit like tilt one's head when writing. Bao and co-authors reported that the near phoria state can affect near vision posture, head tilt angle and ocular gaze angle had a potential relationship with strabismus.<sup>34</sup>

There are some limitations to the present study. Some of the risk factors might be potentially inaccurate due to the self-reported questionnaires from the students' parents, even though the questionnaires used in the LCES were calibrated for cultural differences. In addition, strabismus history and treatment were not remembered by their parents clearly, which could lead to a misestimate for prevalence of strabismus.

## Conclusion

In conclusion, as the first comprehensive school-based cohort study, the LCES had high response rate and good comparability with studies. Moreover, the LCES study is the first longitudinal study on childhood ocular diseases in plateau regions of Chinese children and will continuously performing the follow-up for 5 years and could provide invaluable ophthalmic baseline data for the worldwide eye care.

## Abbreviations

The Lhasa Childhood Eye Study (LCES)

The Anyang childhood eye Study (ACES)

Body Mass Index (BMI,  $BMI = \text{weight}/\text{height}^2 \text{ kg}/\text{m}^2$ )

Best-corrected distant VA (BCVA)

Spherical equivalent (SE)

Superior oblique muscle paralysis (SOP)

Double depressor paralysis (DDP)

Dissociated vertical deviation (DVD)

The Strabismus, Amblyopia and Refractive Error in Singaporean Children (STARS)

Mean  $\pm$  standard deviation (SD)

Confidence interval (CI)

Prism diopters(PD)

## Declarations

### Ethics approval and consent to participate

Ethics committee approval was obtained from the Institutional Review Board of Beijing Tongren Hospital, Capital Medical University (TRECKY2019-146) in accordance with the Declaration of Helsinki principles.

Written informed consent forms were obtained and signed by all parents or guardians before the examinations.

### **Consent for publication**

The authors declare that they agree to publish.

### **Availability of data and material**

Supplied

### **Competing interests**

The authors declare that co-author 'Weiwei Chen' is the member of Editorial Board in this section.

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### **Authors' contributions**

J F, HL H and WW C initiated the study design. ZJ M, L L and XY Z prepared the consent form. HL H and J F drafted and finalized the study protocol. All authors reviewed the study protocol and approved the final manuscript.

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## Tables

Table 1. Characteristics of participants of LCES (N=1856)

Items	Values
Age, years (mean±sd)	6.83±0.46
Gender, n(%)	
Boy	984(53%)
Girl	872(47%)
Ethnic categories, n(%)	
Tibetan Minority	1762(94.9%)
Han Majority	85(4.6%)
Others Majorities	9(0.5%)
Height, cm, (mean±sd)	120.55±5.52
Weight, kg, (mean±sd)	22.96±3.69
BMI, kg/m <sup>2</sup> , (mean±sd)	15.74±1.80
Heart rate, beat, (mean±sd)	95.27±14.27
Oxygen saturation, %, (mean±sd)	92.68±3.07
BCVA, LogMAR, (mean±sd)	
Right eyes	0.05±0.11
Left eyes	0.05±0.10
Cycloplegic SE, D, (mean±sd)	+1.07±0.92
Ocular dominance eyes, n(%)	
Right eyes	1192 (64.2%)
Left eyes	664 (35.8%)

Table 2. Prevalence of strabismus and subtypes (N=1856)

Classification	n(%)
Exotropia	43(2.3)
Basic non-specific type	31(1.7)
Divergence excess	1 (0.1)
Convergence insufficiency type	11(0.6)
Esotropia	8 (0.4)
Accommodative esotropia	5 (0.3)
Non-accommodative esotropias	1 (0.1)
Others	2 (0.1)
Vertical deviation combining horizontal strabismus	8 (0.4)
Exotropia combining SOP	7 (0.4)
Exotropia combining DDP	1 (0.1)
Vertical strabismus	3 (0.2)
SOP	3 (0.2)
Microtropia	2 (0.1)
Others	4 (0.2)
Duane syndrome	2 (0.1)
DVD combining oblique muscle dysfunction	1 (0.1)
Nystagmus for congenital cataract	1 (0.1)
Total	68 (3.7%)

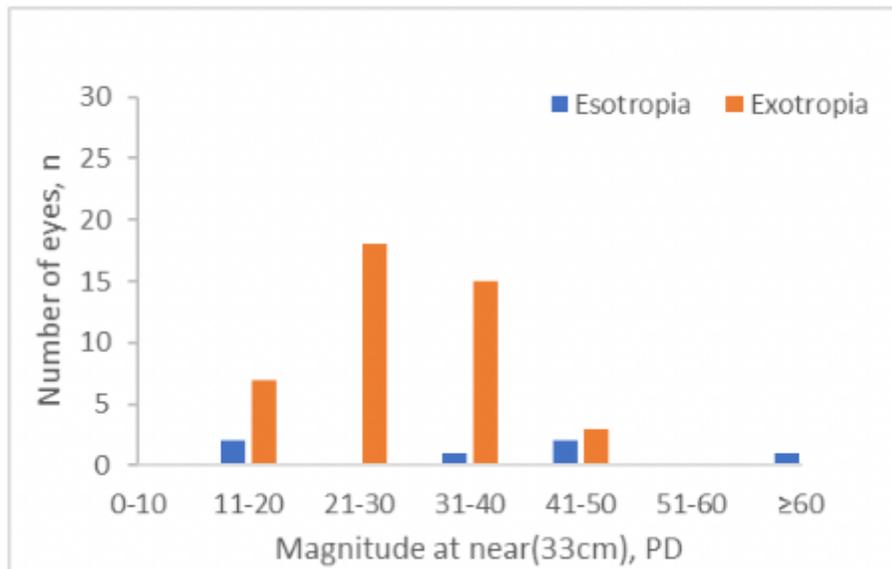
Table 3. Risk factors associated with strabismus

Characters	P	OR[95%CI]
Age	0.9865	1.00(0.59-1.69)
Gender	0.8177	0.94(0.58-1.54)
Ethnic	0.5948	0.56(0.14-2.32)
Height	0.5436	1.01(0.97-1.06)
Weight	0.1509	1.04(0.98-1.11)
BMI	0.1413	1.10(0.97-1.24)
Heartrate	0.3455	0.99(0.98-1.01)
Oxygen saturation	0.9967	1.00(0.92-1.08)
Lamp use	0.2778	0.83(0.59-1.16)
Writing posture	0.0040	1.58(1.16-2.15)
Sleep habits	0.9422	1.04(0.32-3.40)
Pregnancy history	0.6757	1.20(0.51-2.83)
Fruits intake	0.8290	1.07(0.58-1.96)
Vegetables intake	0.7230	1.12(0.61-2.04)

Table 4. Prevalence of strabismus in previous Chinese studies

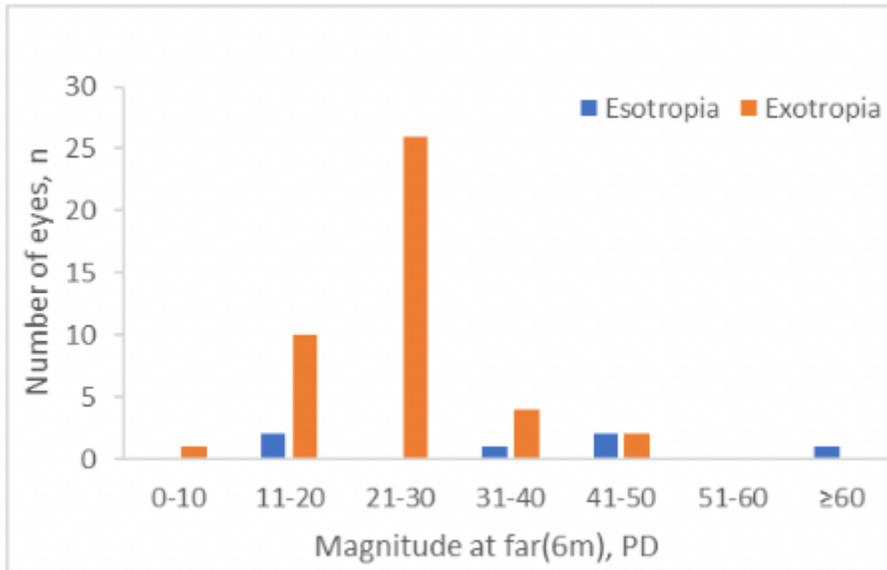
Author	Year	Area	Samples	Age/years	Prevalence/%	Exo:Eso
Zhu H	2019	Yunnan	1656	7-8	1.50	10.6:1
			1394	13-14	2.44	10.6:1
Pan CW	2017	Yunnan	3045	6-8	2.47	10.5:1
			4146	9-11	3.69	
			1745	12-14	4.96	
Pan CW	2016	Nanjing	5831	3-6	5.8	/
Chen X	2016	Nanjing	5884	3-6	5.65	6:1
Fu J	2014	Anyang	3112	7-8	2.73	6:1
			2362	12-13	5.02	5:1:1
Pi LH	2012	Chongqing	3079	6-15	0.29	1.7:1
Lu P	2008	Qinghai	1084	6-14	2.49	5.7:1
He M	2007	Yangxi	2454	13-17	1.63	3.5:1
He M	2004	Guangzhou	4364	5-15	1.9	4:1
Zhao J	2000	Shunyi	5884	5-15	2.8	/

## Figures



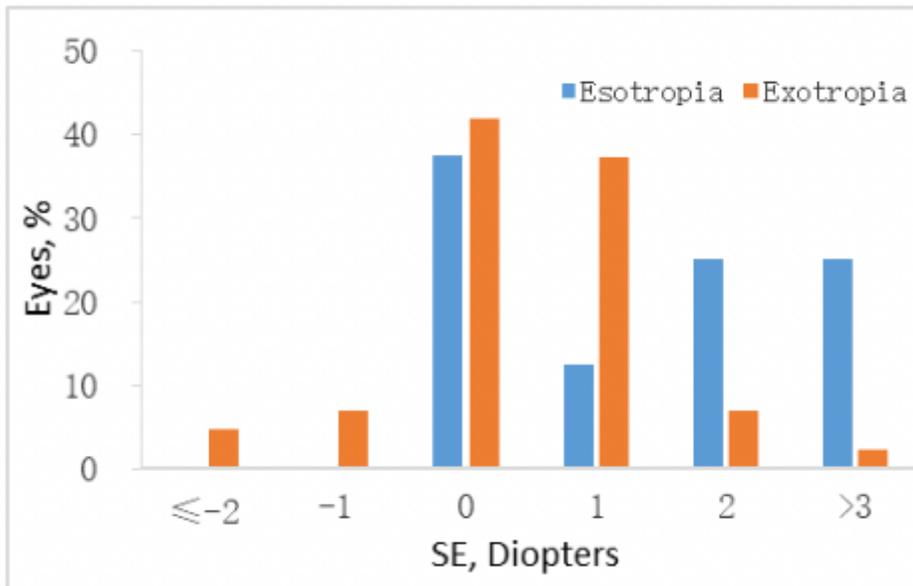
**Figure 1**

Distribution of the magnitude of exotropia and esotropia at 33cm



**Figure 2**

Distribution of the magnitude of exotropia and esotropia at 6m



**Figure 3**

Distribution of the cycloplegic SE of esotropia and exotropia students (right eyes)

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBEchecklist.doc](#)