Prevalence of ametropias and anisometropias in elementary school children in schools from 14 cities in the State of Alagoas

Prevalência de ametropias e anisometropias em crianças no ensino fundamental nas escolas de 14 municípios do Estado de Alagoas

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Study carried out at Instituto de Olhos de Maceió, Maceió - AL

Objective: Evaluate a prevalence of ametropias and anisometropias in elementary school children from 14 cities in the state of Alagoas.

Methods: A retrospective study, total of 40,873 students, between 7 and 15 years of age, were examined. Patients presenting any refractive error were considered ametropic. Only patients claiming eye complaints with spherical errors greater than -0.75D or +2.00D and cylinder error greater than -0.75D were prescribed eyeglasses. Anisometropia was considered when the refractive difference between the two eyes was of 2 diopters or more. Results: 5.2% presented ametropia. Compound myopic astigmatism (28.99%) and compound hyperopic astigmatism (20.39%). Anisometropia was 10.38%. Conclusions: Understanding the prevalence of ametropias and anisometropias among children is essential to implement strategies for the correct diagnosis and treatment of avoidable visual impairment causes.

Keywords: Prevalence; Anisometropia; Ametropia; Refractive errors; Retrospective studies
INTRODUCTION

Visual impairment during childhood due to refractive errors is one of the most common problems among school children, and is the second leading cause of treatable blindness. The integrity of the vision is essential for the child's education. Upon entering school, we began to develop more intensely the intellectual and social activities directly linked to the psychomotor and visual abilities. The greatest obstacle to preventive measures is not the lack of adequate technology, but the inability to create favorable conditions to motivate the population, organize and facilitate access to ophthalmological care.(10).

According to estimates by the World Health Organization (WHO) for the year 2010, the number of visually impaired people in the world is 285 million, of which 39 million are blind and 246 million suffer from moderate or severe vision loss, and 90% of them live in developing countries(2-3). Globally, the main causes of visual impairment are uncorrected refractive error and cataract, 43% and 33% respectively(4). Regarding the prevalence of children under 15 years of age, it is estimated that 19 million have visual problems. Of this total, 12 million suffer from conditions that could be easily diagnosed and corrected. And in this age group 1.5 million suffer from the so-called irreversible blindness, and they will never see again(5).

According to IBGE census of 2010, the number of people who have some visual impairment in Brazil is 30 million, of which 6 million with severe degree and 500 thousand blind(9). The budgetary impact with the estimated loss of global gross domestic product caused by uncorrected refractive errors reaches 202,000 million annually, i.e., the high prevalence of uncorrected refractive error has a major impact on the economic development and quality of life.

The investigation of the prevalence of causes of visual dysfunction allows a better planning of preventive ophthalmological programs. Early identification of ocular problems in children, such as refractive errors, anisometropia and strabismus, contributes to the prevention of permanent damage to binocular vision, leading to amblyopia. In addition, delayed care for children is particularly damaging because of the delay or even irreversible deficit that the visually impaired child may suffer by not being stimulated, educated and/or early rehabilitated(10).

The present study aims at knowing the prevalence of ametropias and anisometropia among children from 7 to 15 years of age in 14 municipalities of the State of Alagoas, as well as to detecting the most common ametropia.

MATERIALS AND METHODS

This retrospective study used data collected from Projeto Saúde Ocular, which was carried out from April to October 2006 in fourteen municipalities located in the dry area in the north-east of the state of Alagoas, in the northeast of Brazil, with its general population totaling approximately 350 thousand inhabitants(8). In total, 351 elementary schools were visited, and 40,873 students ranging in age from 7 to 15 years were examined.

This project assessed the ocular health of children attending elementary school with the use of a mobile ophthalmic unit. The exams were carried out by four ophthalmologists with the aid of five nursing technicians trained in the field of ophthalmology.

Several elementary schools were visited in all municipalities. All patients were cyclopleged using 2 eyedrops of Cyclopentolate Hydrochloride 1%, with a 10-minute interval between instillations, and 30 minutes later the refraction was obtained using the auto refractor Topcon KR 7000 and the subjective refraction was performed.

We considered the following criteria in this study: patients with any refractive error were considered ametropic, only patients with refractive error greater than -0.75R or ≥2.00R spherical or greater than -0.75R cylindrical with relevant visual complaints had glasses prescribed, and anisometropia was considered when the difference was greater than two diopters (both spherical and cylindrical) between refraction of the two eyes.

In order to verify the association between ametropias and gender; and ametropias and age group in contingency tables, the chi-square frequency test was adopted.

The significance level of 5% was considered for all statistical tests.

The program STATA version 7.0 was used to carry out the statistical analyzes.

RESULTS

Of the 40,873 students evaluated, 5.2% presented ametropia, as observed in Table 1, and glasses were prescribed for 4.8%.

Table 2 shows the findings of the ametropias found distributed according to the gender, considering each child as two eyes in isolation. The main refractive errors found were: compound myopic astigmatism (28.99%) followed by compound hypermetropic astigmatism (20.39%) and mixed astigmatism (16.31%). They show a similar distribution of ametropias in relation to the gender.

Table 3 shows the comparison between the frequencies of ametropias in two groups separated by age, trying to show which refractive error is more frequent according to natural growth. It was observed that there is a statistically significant association between age group and ametropias, where compound and simple hypermetropic astigmatism were more frequent in the age group from 6 to 10 years, and compound and simple myopic astigmatism were more frequent in children aged 11 to 15 years (p<0.001).

Table 4 shows the prevalence of anisometropia (≥2 diopters) among ametropic children according to each municipality. A prevalence variation was observed in the comparison of each municipality, ranging from 0% to 16.27%. In the general context of all the ametropic children present in the study, a prevalence of 10.38% was observed in the total of 2129.

DISCUSSION

In public health, screening is necessary, since a large number of children start their school lives without ever having undergone an ophthalmologic examination. About 15% of children in the first school year have some visual impairment, and only 20% of these children have medical follow-up(7-11).

The measurement of visual acuity with the Snellen optotype table is an easy-to-apply and low cost method. It should be widely used by trained personnel with pre-school and school children in needy schools and communities, especially those who do not have ophthalmological services. This practice is quite effective for the early identification of ocular conditions and for early and effective preventive and therapeutic measures(12-13).

The present study found the prevalence of ametropias in 5.2% of the school population. Literature reports that about 10%
Table 1

Distribution of emmetropic and ametropic students according to gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>Girls</th>
<th>Boys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Emmetropic</td>
<td>20051 (94.29)</td>
<td>18693 (95.34)</td>
<td>38744 (94.8)</td>
</tr>
<tr>
<td>Ametropic</td>
<td>1215 (5.71)</td>
<td>914 (4.66)</td>
<td>2129 (5.2)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>21266</td>
<td>19607</td>
<td>40873</td>
</tr>
</tbody>
</table>

p=0.935

Table 2

Distribution of ametropias according to gender

<table>
<thead>
<tr>
<th>Ametropias</th>
<th>Girls</th>
<th>Boys</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compound Hypermetropic Astigmatism (CHA)</td>
<td>492</td>
<td>364</td>
<td>856 (20.39)</td>
</tr>
<tr>
<td>Simple Hypermetropic Astigmatism (SHA)</td>
<td>86</td>
<td>59</td>
<td>145 (3.45)</td>
</tr>
<tr>
<td>Mixed astigmatism (MA)</td>
<td>391</td>
<td>294</td>
<td>685 (16.31)</td>
</tr>
<tr>
<td>Compound myopic astigmatism (CMA)</td>
<td>707</td>
<td>510</td>
<td>1217 (28.99)</td>
</tr>
<tr>
<td>Simple myopic astigmatism (SMA)</td>
<td>353</td>
<td>285</td>
<td>638 (15.19)</td>
</tr>
<tr>
<td>Hyperopia (H)</td>
<td>208</td>
<td>163</td>
<td>371 (8.83)</td>
</tr>
<tr>
<td>Myopia (M)</td>
<td>165</td>
<td>121</td>
<td>286 (6.81)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2402</td>
<td>1796</td>
<td>4198</td>
</tr>
</tbody>
</table>

Table 3

Distribution of ametropias according to the age group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total cases</th>
<th>Age group (years)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq. (%)</td>
<td>6 - 10</td>
<td>11 - 15</td>
</tr>
<tr>
<td>CHA</td>
<td>856</td>
<td>530 (61.9)</td>
<td>326 (32.1)</td>
</tr>
<tr>
<td>SHA</td>
<td>145</td>
<td>93 (64.1)</td>
<td>52 (35.9)</td>
</tr>
<tr>
<td>MA</td>
<td>685</td>
<td>362 (52.8)</td>
<td>323 (47.2)</td>
</tr>
<tr>
<td>CMA</td>
<td>1217</td>
<td>546 (44.9)</td>
<td>671 (55.1)</td>
</tr>
<tr>
<td>SMA</td>
<td>638</td>
<td>305 (47.8)</td>
<td>333 (52.2)</td>
</tr>
<tr>
<td>H</td>
<td>371</td>
<td>217 (58.5)</td>
<td>154 (41.5)</td>
</tr>
<tr>
<td>M</td>
<td>286</td>
<td>138 (48.2)</td>
<td>148 (51.8)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4198</td>
<td>2191</td>
<td>2007</td>
</tr>
</tbody>
</table>

p-value obtained by the chi-square test

of children in this age group have optical prescription, as mentioned in the study by Köhler and Stigmar(14), who screened 2,447 four-year-old children and found the need to prescribe glasses for 8.0% of the population studied. Another study mentioned a prescription rate of 6.33% of glasses(15).

Regarding the prevalence of refractive errors, a higher percentage of astigmatism errors was observed. Compound myopic astigmatism (28.99%) and compound hypermetropic astigmatism (20.39%) were the most common ones. Another study found a higher frequency of simple or compound hypermetropic astigmatism (24.59%), followed by hypermetropia (21.66%), and myopic astigmatism (21.66%).(11)

When we compare refractive errors according to the age groups from 6 to 10 years and from 11 to 15 years, we know that, although poorly understood, there are mechanisms to coordinate the structural and optical development of the eye. Thus, there is a process of emmetropization through which the hyperopic eye of the newborn is progressively led to emmetropia(16,17). During the phase of physiological hyperopia (5-12 years), patients who read too closely and who will therefore have visual blurring stimulate the production of growth factors in the eye. This phenomenon, in addition to the physiological emmetropization, will ultimately result in abnormal stretching of the eye (myopia). It was observed in the present study that there is a statistically significant association between these age groups, where compound and simple hypermetropic astigmatism were more frequent in the age group from 6 to 10 years, and compound and simple myopic astigmatism were more frequent in children aged 11 to 15 years.

Among the 2129 students with ametropias, anisometropia (same criterion used in other studies, ≥ 2 diopters) was observed
in 221 children (10.38%), a number considered very high when compared to other studies, and worrisome due to the risk of amblyopia. There is a wide variation in other epidemiological studies, for example, in China and New York a prevalence of anisometropia of 2.97% and 2.8% respectively is detected\(^{11,16,19}\). Another study in Boston, USA, found a lower prevalence of 1%\(^{22}\). Others in the Netherlands and India detected a high prevalence of 4.7% and 3.5%, respectively\(^{20,21}\).

The data collected in this study is of significant importance since all the elementary school children in 14 municipalities in the rural area of Alagoas had authorization from their legal representatives to be treated in a mobile unit that stayed for a few days in the schools to meet the students, which led to practically no absences.

Several works showed a high rate of absences, as in Londrina (24.6% in public and 30.6% in private schools)\(^{23}\), Sorocaba (11.9%)\(^{26}\) and São Paulo (more than 50%)\(^{25}\). This can be attributed to several factors, such as the lack of awareness about the importance of subjecting children to ophthalmologic care by parents or legal representatives\(^{23}\), the difficulty in transportation, poor guidance, and missed work day, as reported by parents of schoolchildren in the city of São Paulo\(^{25}\). This can result in losses for both children and the public health system, since it is much easier and cheaper to correct ocular problems before they progress to something more severe and not treatable, since more than 90% of ophthalmic problems can be avoided or lessened with simple preventive actions, in addition to being an important contribution to strategies for diagnosis and correct treatment of avoidable causes of low vision, by means of campaigns to stimulate the population to seek specialists whenever they face a symptom of anisometria in the child, thus avoiding the development of amblyopia, the delay in the intellectual and social development of these patients, and consequent socio-economic impact in the future.

**CONCLUSION**

After analyzing data from 40873 children in 14 municipalities of Alagoas, the statistically significant data in this study allowed us to conclude that the prevalence of refractive errors was 5.2%, and in 4.8% of cases glasses were prescribed. Among these errors, the most common ones were compound myopic astigmatism (28.99%), compound hypermetropic astigmatism (20.39%) and mixed astigmatism (16.31%). When separated by age group, it was observed that errors related to hyperopia were more frequent in the age group from 6 to 10 years, and errors related to myopia were more frequent in age group from 11 to 15 years. Of the 2029 children with refractive errors, 10.38% presented anisometropia (difference between the two eyes ≥ 2 diopters), a cause of concern due to the risks of amblyopia.

The results presented in this study confirm that the problem is a public health concern, and knowing the child-juvenile prevalence of ametropias in the population is key for the adoption of strategies for diagnosis and correct treatment of avoidable causes of low vision, by means of campaigns to stimulate the population to seek specialists whenever they face a symptom of anisometria in the child, thus avoiding the development of amblyopia, the delay in the intellectual and social development of these patients, and consequent socio-economic impact in the future.

**REFERENCES**


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