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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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ABSTRACT

Objective: *Evaluate a prevalence of ametropias and anisometropias in elementar 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%). And anisometropias 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*

RESUMO

Objetivo: Objetivo: Avaliar a Prevalência de ametropias e anisometropias em crianças no ensino fundamental nas escolas de 14 municípios do estado de Alagoas. **Métodos:** Realizado um Estudo retrospectivo com dados de 40.873 alunos na faixa etária de 7 a 15 anos. Os pacientes com qualquer erro refrativo foram considerados ametropes e erros maiores que – 0,75D ou + 2,00D esféricos ou maiores que -0,75D cilíndricos com queixas visuais significativas tiveram óculos prescritos e anisometropia considerada com a diferença maior de duas dioptrias. **Resultados:** Encontrado prevalência, 5,2% de ametropias. Astigmatismo miópico composto (28,99%), seguido de astigmatismo hipermetrópico composto (20,39%). E anisometropia, de 10.38%. **Conclusão:** Conhecer a prevalência infanto-juvenil de ametropias e anisometropia na população é fundamental para a adoção de estratégias para diagnóstico e tratamento correto de causas evitáveis de baixa visão.

Descritores: Prevalência; Anisometropia; Ametropia; Erros de refração; Estudo retrospectivos

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Introduction

Visual impairment during childhood due to refraction 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.[1].

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[2].

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[5]. 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[6].

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[5]. 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 cyclopleghed 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, 8-11].

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

Variable	Girls N (%)	Boys N (%)	Total N(%)
Emmetropic	20051 (94.29)	18693 (95.34)	38744 (94.8)
Ametropic	1215 (5.71)	914 (4.66)	2129 (5.2)
TOTAL	21266	19607	40873

p=0.935

Table 2

Distribution of ametropias according to gender

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

Table 3

Distribution of ametropias according to the age group

Variable	Total cases Freq. (%)	Age group (years) 6 - 10 Freq. (%)	11 - 15	p-value
CHA	856	530 (61.9)	326 (32.1)	<0.001
SHA	145	93 (64.1)	52 (35.9)	
MA	685	362 (52.8)	323 (47.2)	
CMA	1217	546 (44.9)	671 (55.1)	
SMA	638	305 (47.8)	333 (52.2)	
H	371	217 (58.5)	154 (41.5)	
M	286	138 (48.2)	148 (51.8)	
TOTAL	4198	2191	2007	

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

Table 4

Distribution of anisometropias by municipality

Municipalities	Emmetropic	Ametropic	Anisometropic (%)
Cajueiro	2975	144	13 (9.02)
Campo Grande	1663	70	4 (5.71)
Capela	2000	110	17 (15.45)
Igreja Nova	3234	129	21 (16.27)
Jequiá	1576	84	11 (13.09)
Matriz de Camaragibe	2413	99	5 (5.05)
Piaçabuçu	2113	146	12 (8.21)
Porto Calvo	2793	106	11 (10.37)
Quebrangulo	1480	78	8 (10.25)
Rio Largo	6448	342	25 (7.30)
São Luiz do Quitunde	4064	142	21 (14.78)
São Miguel dos Milagres	785	18	0 (0)
Teotônio Vilela	5065	322	34 (10.55)
Viçosa	2432	341	39 (11.43)
TOTAL	**38744**	**2129**	**221 (10.38)**

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[18-19]. 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, such as in Londrina (24.6% in public and 30.6% in private schools)[23], Sorocaba (11.9%)[24] 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 fighting the high rates of flunking and school dropout Which greatly affect the first grade[26-27]. In addition, said high absence rate may be responsible for an underestimation of the result if a greater proportion of individuals with low visual acuity were absent on the day of assessment[20].

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 ametropia 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

1. Sommer A. Organizing to prevent Third World blindness. Am J Ophthalmol. 1989 ;107(5):544-6. Comment in: Am J Ophthalmol. 1898;108:466-7.
2. Mariotti SP. Global Data on Visual Impairments 2010. Geneva: World Health Organization; 2012.
3. Albuquerque RC, Alves JGB. Afecções oculares prevalentes em crianças de baixa renda atendidas em um serviço oftalmológico na cidade do Recife - PE, Brasil. Arq Bras Oftalmol. 2003; 66(6):831-4.
4. Resnikoff S, Pascolini D, Mariotti SP, Pokharel GP. Global magnitude of visual impairment caused by uncorrected refracion errors in 2004. Bull World Health Organ. 2008 Jan;86(1):63-70.
5. Instituto Brasileiro de Geografia e Estatística (IBGE). Manual do entrevistador dos censos demográficos de 1991, 2000 e 2010. Brasília (DF):IBGE; 2010.
6. Kara José N, Carvalho KM, Pereira VL, Venturini NH, Gasparetto ME, Gushiken MT. Estudo retrospectivo dos primeiros 140 casos atendidos na clínica de visão subnormal do Hospital de Clínicas da Unicamp. Arq Bras Oftalmol. 1988; 51(2):65-9.
7. Moreira JB. Censo pré-escolar e prevenção da cegueira. Arq Bras Oftalmol. 1980; 43(2): 53-4.
8. Beer SM, Scarpi MJ, Minello AA. Achados oculares em crianças de zero a seis anos de idade, residentes na cidade de São Caetano do Sul, SP. Arq Bras Oftalmol. 2003; 66(6): 839-45 .
9. Lopes GJ, Casella AM, Chuí CA. Prevalência de acuidade visual reduzida nos alunos da primeira série do ensino fundamental das redes pública estadual e privada de Londrina-PR, no ano de 2000. Arq Bras Oftalmol. 2002; 65(6): 659-64 .
10. Scarpi MJ, Kara-José N, Taiar A. Incidência de ambliopia em 1400 escolares da cidade de São Paulo, em 1975. Arq Bras Oftalmol. 1977; 40(1):16-23.
11. Schimiti RB, Costa VP, Gregui MJ, Kara-José N, Temporini ER. Prevalence of refractive errors and ocular disorders in preschool and schoolchildren of Ibiporã-PR, Brazil (1989 to 1996). Arq Bras Oftalmol. 2001; 64(5): 379-84.
12. Temporini ER. Níveis de prevenção de problemas oftalmológicos: Propostas de investigação. Rev Bras Oftalmol. 1993; 52(4): 49-52.
13. Vieira C, Rodrigues MLV. Prevenção da cegueira nas escolas rurais da região de Santa Bárbara D'Oeste - SP. Rev Bras Oftalmol. 1995; 54(2):43-7.
14. Köhler L, Stigmar G. Vision screening of four-year-old children. Acta Paediatr Scand. 1973;62(1):17-27.
15. Costa MN, Kara José N, Machiaverni Filho N, Rangel FF, Rueda G, Pereira VL, et al. Estudo da incidência de ambliopia, estrabismo e anisometropia em pré-escolares. Arq Bras Oftalmol. 1979;42:249-52.

16. Brown NP, Koretz JF, Bron AJ. The development and maintenance of emmetropia. Eye (Lond). 1999;13 (Pt 1):83-92.
17. Troilo D. Neonatal eye growth and emmetropisation—a literature review. Ere (Lond). 1992;6 (Pt 2)154-60
18. Li L, Ma Y, Hu X. A research of infant refraction in Kumming Municipality. Zhonghua Yan Ke Za Zhi. 2001;37(1):24-7.
19. Almeder LM, Peck LB, Howland HC. Prevalence of anisometropia in volunteer laboratory and school screening populations. Invest Ophthalmol Vis Sci. 1990;31(11):2448-55.
20. De Viries J. Anisometropia in children: analysis of a hospital population. Br J Ophthalmol. 1985;69(7):504-7.
21. Gupta M, Gupta Y. A survey on refractive error and strabismus among children in a school at Aligarh. Indian J Public Health. 2000;44(3):90-3
22. Mayer DL, Hansen RM, Moore BD, Kim S, Fulton AB. Cycloplegic refractions in healthy children aged 1 through 48 months. Arch Ophthalmol. 2001; 119(11):1625-8.
23. Lopes GJ, Casella AM, Chuí CA. Prevalência de acuidade visual reduzida nos alunos da primeira série do ensino fundamental das redes pública estadual e privada de Londrina-PR, no ano de 2000. Arq Bras Oftalmol. 2002; 65(6):659-64.
24. Gianini RJ, Masi E, Coelho EC, Oréfice FR, Moraes RA. Prevalência de baixa acuidade visual em escolares da rede pública, Sorocaba. Rev Saúde Pública. 2004; 38(2):201-8.
25. Alves MR, Temporini ER, Kara-José N. Atendimento oftalmológico de escolares do sistema público de ensino no município de São Paulo: aspectos médicos-sociais. Arq Bras Oftalmol. 2000; 63(5):359-63.
26. Alves MR, Kara-José N. Manual de orientação. Campanha Veja Bem Brasil. São Paulo: Conselho Brasileiro de Oftalmologia; 1998.
27. Alves MR, Kara-José N. Campanha Nacional de Reabilitação Visual: Manual de orientação. Sõ Paulo: Conselho Brasileiro de Oftalmologia; 1999.

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