

# Evaluation of visual acuity in municipal elementary school students

## *Avaliação da acuidade visual em escolares do ensino fundamental*

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### ABSTRACT

**Objective:** To describe and analyze the prevalence of visual impairment in municipal public school students in Cáceres, Mato Grosso. **Methods:** A transversal study of 489 school children from the second and third years of elementary school in 13 municipal schools in Cáceres, attended between December 2017 and January 2018. Visual acuity was evaluated using Snellen optometric chart and considered normal when higher than 0.7 or 20/30. **Results:** Of the four hundred and eighty-nine children were evaluated, eighty-five (17.4%) had low visual acuity at the screening, being referred for ophthalmological examination with specialist. Of the students referred, sixty three (74.1%) presented at the ambulatory and twenty eight (44.45%) had indication of visual correction, having won the glasses. The prevalence of refractive error was 8.99%, constituting the main cause of low visual acuity. The mean age was 8.29 anos (SD = 0.809), being an average of children with ophthalmological alterations was higher when compared to those without ophthalmological alterations ( $p = 0.027$ ). **Conclusion:** The study showed that the prevalence of low visual acuity, as well as its causes, corroborates with that found in other screening programs in school children. It also demonstrated the importance of early diagnosis of visual changes to get better outcomes and emphasized the need for preventive measures for attention to eyes health of school children.

**Keywords:** Visual acuity; Refraction errors; Eye diseases; Eye health; Child; Education, primary and secondary; Mass screening

### RESUMO

**Objetivo:** Descrever e analisar a prevalência de baixa acuidade visual nos estudantes da rede pública municipal de Cáceres, Mato Grosso. **Métodos:** Estudo transversal de 489 alunos do segundo e terceiro anos do ensino fundamental de 13 escolas municipais de Cáceres, atendidos entre dezembro de 2017 e janeiro de 2018. A acuidade visual foi avaliada através do uso da tabela de Snellen e considerada normal quando superior a 0,7 ou 20/30. **Resultados:** Dos 489 escolares triados, 85 (17,4%) apresentaram baixa acuidade visual, sendo encaminhados para exame oftalmológico com especialista. Dos escolares encaminhados, 63 (74,1%) compareceram à consulta e 28 (44,45%) tiveram indicação de correção visual, tendo ganhado os óculos. A prevalência de erros refrativos foi de 8,99%, constituindo-se a principal causa de baixa acuidade visual. A média de idade foi de 8,29 anos (DP= 0,809), sendo que a idade média das crianças com alterações oftalmológicas foi maior quando comparada àquelas sem alterações oftalmológicas ( $p = 0,027$ ). **Conclusão:** O estudo mostrou que a prevalência de baixa acuidade visual, bem como suas causas, corrobora com a encontrada em outros programas de triagem em escolares. Demonstrou também a importância do diagnóstico precoce das alterações visuais para obtenção de melhores desfechos e ressaltou-se a necessidade de medidas preventivas para atenção à saúde ocular dos escolares.

**Descritores:** Acuidade visual; Erros de refração; Oftalmopatias; Saúde ocular; Saúde escolar; Criança; Educação primária e secundária; Programa de rastreamento

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## INTRODUCTION

Among the sense organs, sight is responsible for capturing most of the sensory stimuli which guarantees an interaction between the external environment and the organism. It is an important tool for the intellectual construction of the individual, allowing the improvement of their intellectual, psychomotor and social skills.<sup>(1)</sup>

World Health Organization (WHO) estimates show that there are approximately 285 million people with visual impairment in the world, of which 39 million are blind and 246 million have low vision. Data indicate that there are about 19 million children with visual problems. However, it is known that 80% of these cases are treatable or could have been prevented.<sup>(2)</sup>

According to the Brazilian Council of Ophthalmology (CBO), about 20% of schoolchildren present some ophthalmological alterations. Moreover, approximately 10% of students in elementary school need correction for some refractive error.<sup>(3,4)</sup>

WHO recommends the implementation of ocular health prevention programs since 1970. In association with the International Agency for the Prevention of Blindness, they created the Vision 2020 Program aiming at reducing avoidable blindness worldwide by the year 2020, especially in children at Schools. In Brazil, the first program aimed at elementary schoolchildren took place in 1998, the National Campaign to Prevent Blindness and Visual Rehabilitation - *Veja Bem Brasil*, which benefited one 1.5 million schoolchildren.<sup>(5,6)</sup>

Visual acuity is defined as the instrument to evaluate the recognition of separation between two separate points in space. Studies involving children indicate that the prevalence of low visual acuity in this age group ranges between 7.6% and 29%. Visual screening allows the early identification of eye problems, contributing to the prevention of permanent damage to vision.<sup>(7)</sup>

## METHODS

The study consisted of an observational cross-sectional study with the objective of verifying the prevalence of low visual acuity in schoolchildren enrolled in the second and third years of primary education in the municipal public network of Cáceres-MT.

The research protocol was approved by the Research Ethics Committee of Universidade do Estado de Mato Grosso (UNEMAT), CAAE: 70092017.8.0000.5166.

The visual acuity of children of 13 municipal schools in Cáceres-MT was measured between December 2017 and January 2018. At each school, the researchers delivered a form to fill in information, and the consent and assent terms to each child.

The information on the form was: general characteristics of the individual (gender and age), use of glasses or contact lenses, previous ophthalmologic exams, presence of previous comorbidities and pathologies, and the child's perception of their vision.

The visual screening was the responsibility of the academic researcher instructed and supervised by the researcher ophthalmologist. All students who attended the school on the date and who presented the terms duly authorized and signed by the parents were examined.

Visual acuity assessment was carried out using Snellen's optometric scale, which was placed in a well-lit, calm, non-glare environment, set at 6 meters from the student. Each eye was

assessed separately, initially the right eye and then the left eye. Children wearing glasses were evaluated initially without correction and then using the lenses. The examiner recorded the value equivalent to the last line read without difficulty, that is, the best visual acuity obtained in each eye.

Children who had low visual acuity were referred to a complete ophthalmologic examination. Visual acuity (VA) greater than 0.7 or 20/30 was considered normal. Students who did not reach 0.7 were reassessed. Following WHO guidelines, after screening they were referred:

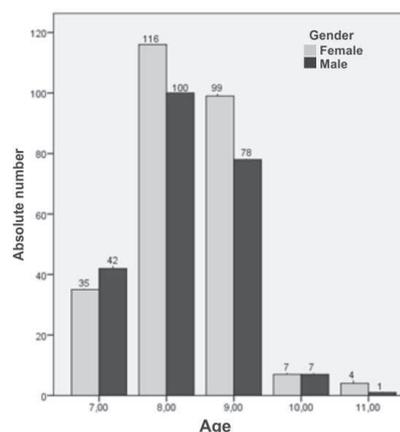
- Schoolchildren with VA equal to or less than 0.7 (20/30) in at least one eye with or without signs and symptoms;
- Schoolchildren with a difference of vision between the eyes of two or more lines on the Snellen optometric scale;
- Schoolchildren with strabismus.

The complete ophthalmologic examination occurred in the university institution Centro Oftalmológico de Cáceres. The students referred were evaluated by an ophthalmologist. A new visual acuity measurement, static and dynamic lens test, biomicroscopy, static and dynamic retinoscopy and funduscopy were performed. The students evaluated with the correct indication for visual correction received the prescription, and all glasses were donated at no cost to the students.

After the data collection, the data was processed and analyzed with the program Statistical Package for Social Sciences (SPSS), version 20.0. Descriptive statistics were used to analyze the absolute and relative frequencies of the same. In order to analyse the proportion with categorical variables, the chi-square test with 95% confidence interval and the Fischer's exact test were used. For the analysis of continuous data, averages were compared with the T-test.

## RESULTS

A total of 489 children participated in the study, of which 261 were female (53.4%) and 228 male (46.6%). The average age was 8.29 years  $\pm$  0.809. There was no significant association between the presence of low visual acuity and the age of the children ( $\chi^2 = 5.631$ ,  $p = 0.344$ ). Figure 1 shows the age group of the participating children ranging from 7 to 12 years according to gender.



**Figure 1:** Distribution of schoolchildren by age and gender.

Of the children examined, 18 (3.7%) already wore eyeglasses and/or contact lenses, whereas 433 (88.5%), when questioned, never

underwent a previous ophthalmological evaluation. Table 1 shows the main characteristics of the study population.

As for the school grade, 228 children (46.6%) were in the second year, and 261 children (53.4%) were in the third year of elementary school. The prevalence of low visual acuity (less than or equal to 0.7 or 20/30) was 17.4% among the total number

**Table 1**  
Distribution of the study population according to gender, previous ophthalmologic examination, and prior use of glasses

Variables	N	%
<b>Gender</b>		
Male	228	46.6
Female	261	53.4
<b>Prior ophthalmologic examination</b>		
Yes	56	11.5
No	433	88.5
<b>Prior use of glasses and/or contact lenses</b>		
Yes	18	3.7
No	471	96.3

of students, so that they were referred for complementary evaluation with an ophthalmologist. The remaining 404 children (82.6%) were guided on the importance of periodic ophthalmologic evaluation.

Eighty-five children were referred, of which 63 (74.1%) attended the appointment on the date scheduled, and 22 (25.9%) did not attend.

After the final evaluation, the causes of low visual acuity in these children were refractive errors (myopia, hypermetropia and astigmatism), strabismus, amblyopia, congenital cataract, retinocoroiditis, and keratoconus.

The prevalence of refractive errors identified in the students who participated in the screening was 8.99%, as described in the table below. The prevalence of astigmatism was the highest (5.52%), being the main cause of refractive errors in the diagnosed children (Table 2).

The prevalence of ophthalmopathies in schoolchildren was 3.03%, as described in table 3. The prevalence of allergic conjunctivitis was higher than the others. There were two cases of bilateral retinocoroiditis, both of which caused by congenital toxoplasmosis.

Of the students attending the appointment, 28 (44.45%) received prescription to wear glasses. The prevalence of low visual acuity

**Table 2**  
Prevalence of refractive errors in schoolchildren in municipal schools

Refractive errors	N	Prevalence in relation to the total number of children (489)%	Proportion of refractive errors in relation to total ametropias diagnosed (44)%
<b>Hiperopia</b>	14	2.86	31.81
<b>Physiological</b> (< 3,0 di)	13	2.65	29.54
<b>Pathological</b> (≥ 3,0 di)	1	0.21	2.27
<b>Myopia</b>	3	0.61	6.81
<b>Astigmatism</b>	27	5.52	61.37
<b>Total</b>	44	8.99	100

**Table 3**  
Prevalence of ophthalmopathies in schoolchildren in municipal schools

Ophthalmopathies	N	Prevalence in relation to the total sample (489)%
<b>Amblyopia</b>	4	0,82
<b>Strabismus</b>	2	0,4
<b>Congenital cataract</b>	1	0,2
<b>Retinocoroiditis</b>	2	0,4
<b>Keratoconus</b>	2	0,4
<b>Allergic conjunctivitis</b>	5	1,02
<b>Total exams</b>	63	3,03

was higher in users of glasses (50.0%) than in those who did not use correction (16.3%).

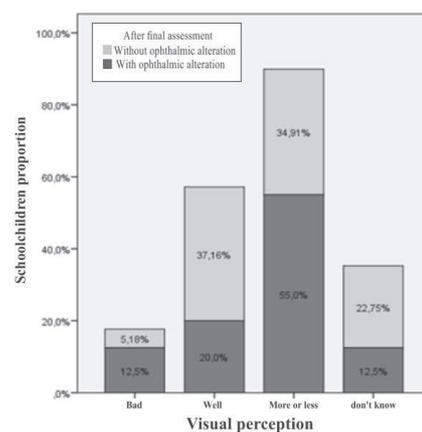
The average age of the children with ophthalmologic alterations was 8.38 (SD = ± 0.74), and the average of those without ophthalmological alterations was 7.91 (SD = ± 0.848), statistically significant (p = 0.027).

The prevalence of low visual acuity among the total number of female students was 19.15%, whereas in males it was 15.35%.

As for visual perception, among those children who had ophthalmological alterations the proportion of those who affirmed seeing “more or less” was 55%, whereas the proportion of those who

said they saw “well” was 20%, statistically significant (x2 = 12.79; p = 0.012), as described in figure 2.

In the analysis of the visual perception of the schoolchildren evaluated, the probability of those who say they see “more or less” to have visual deficit is 5 times higher than those who say they see “poorly” (OR = 5.13, p = 0.032).



**Figure 2:** Proportion of schoolchildren with and without ophthalmological alteration according to the visual perception.

## DISCUSSION

The relevance of the present study is anchored to the various aspects contemplated by the research: survey of an index of the municipality of Cáceres until then unknown by the scientific community; the inclusion of a sample with an age group subject to early interventions; awareness of the population and authorities on the importance of the evaluation tool as a diagnostic tool; and the detection of cases of low visual acuity in the children of the municipality.

Public policies focused on ocular health are scarce in the Brazilian socioeconomic context. Visual screening programs are of fundamental importance to know the epidemiological profile of the main eye diseases, since they are of relatively simple planning, with low cost and high sensitivity for the detection of altered cases. In Brazil, a study on the main causes of blindness and low vision has shown that 59% of ocular diseases are preventable or treatable.<sup>(1-3)</sup>

Knowing the health of the population allows us to design more effective assistance strategies. An important fact is that the population's eye health should start early, especially in childhood. Children, especially before entering school, are in a way incapable of discerning good vision from altered one. From school entry, work activities require a greater visual capacity of the children, thus evidencing the observational role of the teacher to identify behaviors suggestive of decreased visual acuity. It was not the objective of the present study to seek the association between low visual acuity and school dropout.<sup>(3)</sup>

Socioeconomic conditions and local cultures are factors that make it difficult for the child to have an ophthalmological exam before entering school. In the present study, 88.5% of the total number of schoolchildren had never undergone previous ophthalmological evaluation. Estacia et al.<sup>(8)</sup> and Toledo et al.<sup>(9)</sup> observed that 81.81% and 67.7% of schoolchildren, respectively, did not have ophthalmological assistance before school entry. The potential reasons for this are mainly the lack of awareness of parents about the impact of eye diseases on the quality of life of the child, as well as the scarcity of financial resources when it comes to a population with lower purchasing power. This fact also shows an alarming reality: ocular health care in our country is poor, and children are not being adequately investigated.<sup>(4)</sup>

Zanoni et al.<sup>(5)</sup> indicates that the incidence of visual problems increases in the age group between 6 and 8 years of age, which is the period of school entry, thus justifying the visual screening in the school environment as a diagnostic tool. This study obtained an average age of 8.29 years  $\pm$  0.809, being therefore at the higher age limit. The earlier the diagnosis, the better the prognosis and the greater the chances of obtaining better results and reducing losses. Late diagnosis may lead to delayed psychomotor and school development, as well as interference in social interaction.<sup>(9,10)</sup>

In the literature, the prevalence of low visual acuity ranges from 3.5 to 34.83%. Granzoto et al.<sup>(3)</sup> found a prevalence of low visual acuity in Pelotas-RS of 15.1%. Couto Junior<sup>(1)</sup>, reported prevalence of 33.83% in children in the municipality of Duque de Caixas-RJ. Estacia et al.<sup>(8)</sup> reported a prevalence among schoolchildren in Passo Fundo-RS of 10.88%. In 2011, Ribeiro et al.<sup>(11)</sup> reported prevalence of low visual acuity of 10.33% in the children of Belo Horizonte-MG. Among the elementary school students in Cáceres-MT, this study revealed the prevalence of low

visual acuity of 17.4% of the total number of students examined, with no preference for gender, being the age group of 7 years the most affected one, corroborating the results found in the literature with an expected prevalence rate.

The statistical differences found can be justified by the methodology adopted and by the way in which the people who were trained for the screening apply it in practice. This study had presented a difficulty: not all children enrolled in the 2nd and 3rd years of elementary school in the municipal schools of Cáceres were already fully literate. Thus, during screening with the Snellen table, the fact that the child does not respond when requested by the examiner doubts whether the child is not seeing or does not really know the table optotypes, which are letters of the alphabet used by normative grammar.<sup>(8)</sup>

In the present study, of the 85 students referred for secondary ophthalmologic evaluation, 74.1% attended, with 25.9% being absent. This adherence is high when compared to other studies in which the absence rate was high. The study by Estacia et al.<sup>(8)</sup> showed absence rate of 48,84%. But the study by Lopes et al.<sup>(12)</sup> showed 24,6% of absence in the state network of Londrina-PR. In Sorocaba-SP, Gianini et al.<sup>(13)</sup> had 11,9%, whereas the study by Ribeiro et al.<sup>(11)</sup> showed absence of 73,34% in Belo-Horizonte-MG.

Low adherence to visual screening programs is frequent in the literature. The main related causes are access to supplementary health in some population segments; difficulty in getting to the ophthalmological evaluation site; and loss of the working day. In order to minimize these potential obstacles, the present study had the participation of the pedagogical teams of the schools. The parents of the children who were referred were called to the school, so that the children didn't take this responsibility because they could either lose the referral or forget to handle it. In addition, a telephone contact was made and the day of the appointment was scheduled for a Saturday, considering that one of the reasons for abstention was the loss of the working day, which usually is from Monday to Friday.<sup>(11,13)</sup>

Despite the measures taken, absence in our study was 25.9%, which can be explained by the fact that some of the municipal schools in Cáceres include children who live in the rural area of the municipality and who use public school transportation to go to the city. Added to this is the fact that the screening was carried out in the schools of the municipality, and the secondary ophthalmological examination was at Centro Oftalmológico de Cáceres. One way to optimize it would be to get the ophthalmologist to school for better results and less absence.

The main causes of low visual acuity observed in schoolchildren of Cáceres-MT were refractive errors, followed by amblyopia and strabismus. The prevalence of refractive errors was 51.76% among children with low visual acuity, and 8.99% when compared to the total number of students who participated in the screening. These values do not differ much from those found in the literature. In 2007, Estacia et al.<sup>(8)</sup> reported a prevalence of refractive error of 70.46% among children referred, and 3.92% in relation to the total sample. Lopes et al.<sup>(12)</sup> found a prevalence of 37.6% refractive errors among schoolchildren with low visual acuity, and 4.86% in relation to the total. Schimiti et al.<sup>(14)</sup> found a prevalence of 31.23% refractive errors among schoolchildren with low visual acuity, and 4.56% in relation to the total schoolchildren assessed. Oliveira et al.<sup>(15)</sup> found a prevalence of 10% of amblyopia in Rio de Janeiro. Perhaps the sample size and the related socioeconomic and demographic characteristics are factors that can justify the statistical differences found.<sup>(16)</sup>

Among the refractive ametropias, the most prevalent diagnosis isolated or associated was astigmatism (5.52%), followed by physiological hypermetropia (2.65%), and the least prevalent one was myopia (0.61%). This sequence of prevalence among refractive errors was also detected by de Oliveira et al.<sup>(10)</sup> in Botucatu-SP, and by Ribeiro et al.<sup>(11)</sup> in Belo Horizonte-MG. It is true that refractive errors are the main cause of low visual acuity in schoolchildren, and it is important to emphasize that during childhood hypermetropia can be physiological, overestimating the values found when it is not different from pathological hypermetropia.

Regarding visual self-perception, low visual acuity was more prevalent in those schoolchildren who stated they saw “more or less” when compared to those who said they saw “well”. Despite this, there were patients who said they saw poorly, but had normal visual acuity after evaluation. The same occurred in studies such as Toledo, in which a significant rate of low visual acuity was found in students who reported having altered vision when answering the questionnaire applied.<sup>(9)</sup>

The present study showed that the schoolchild who said “more or less” had a chance five times higher of having low visual acuity when compared to those who said they saw “poorly”. The data found in the present study reflect the difficulty of schoolchildren in expressing their visual perception, evidencing their inability to differentiate good vision from the one with impaired visual acuity. Since a large proportion of schoolchildren have never undergone previous ophthalmological evaluation, this manifestation will only occur after school admission, when the demand for visual capacity will be higher than that of the home environment.

The relevance of the present study is also because the average age of children with ophthalmological alterations was statistically higher in relation to those without visual alteration. The longer the delay in determining visual impairments, the lower the chances of recovery and correction of the problem. Early intervention is necessary because children who had visual alterations were older than those without visual alterations. If they had been diagnosed before, maybe they would not have the visual deficits they have now presented.

## CONCLUSION

In view of the above, it can be inferred that our results suggest knowledge acquisition for the scientific community, since it reinforces the idea that visual screening is an important tool for the early diagnosis of vision deficit cases. In addition, the study exposes unknown data on school health in Cáceres-MT.

The prevalence of low visual acuity among schoolchildren in the municipal network of Cáceres-MT is still high, justifying the need to include ophthalmologic evaluation in public health strategies. The earlier the diagnosis, the better the prognosis for these children.

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