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Evaluation of visual acuity in young students at an education institution in Paulista, Pernambuco

Avaliação da acuidade visual nos escolares de uma instituição de ensino em Paulista, Pernambuco

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Abstract

Introduction: Vision is responsible for most of the information and sensory perception an individual receives from the environment, thus considered important for communication and learning. Ophthalmological screening is fundamental for evaluating visual acuity (VA) and early detection of diseases. The Snellen chart is a widely used tool for this evaluation. **Objectives:** To evaluate the VA of preschool and elementary students at an educational institution in Paulista, Pernambuco, using the Snellen chart, and refer those with reduced VA for specialized ophthalmological evaluation. **Methods:** This quantitative cross-sectional study was conducted from May to September 2023 with 216 preschool and elementary students from *Creche Escola Nossa Senhora do Ó* in Paulista, Pernambuco. **Results:** A total of 123 students were included, with a mean age of 7.7 ± 3.4 years. Among them, 66.6% had decreased VA, which was significantly associated with educational level ($p < 0.001$) and age ($p < 0.001$). **Conclusions:** Although the Snellen chart does not replace a comprehensive ophthalmological examination, this valid and practical method is relevant to public health, as it may identify potential visual impairments related to VA.

Keywords: Visual acuity; Optometry; School health services; Ocular health

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Resumo

Introdução: A visão é responsável pela maior parte da informação e percepção sensorial que o indivíduo recebe do meio externo, porquanto considerada um importante componente na comunicação e instrumento primordial no processo de aprendizagem. Desse modo, a triagem oftalmológica é de suma importância para a avaliação da acuidade visual, bem como para a detecção precoce de doenças, sendo a Escala Optométrica de Snellen, utilizada como padronização mundial, uma ferramenta útil nesse processo de triagem. **Objetivo:** Avaliar a acuidade visual dos escolares de uma instituição de ensino no município de Paulista (PE), por meio da aplicação da Escala de Snellen, encaminhando os que possui redução da acuidade visual para avaliação oftalmológica especializada. **Métodos:** Trata-se de um estudo quantitativo do tipo observacional de delineamento transversal, realizado no período de maio a setembro de 2023, com 216 escolares do ensino infantil ao fundamental da Creche Escola Nossa Senhora do Ó, no município de Paulista (PE). **Resultados:** Fizeram parte da análise 123 escolares, com idade média de 7,7 anos ± 3,4, dos quais 66,6% da amostra foi detectada com diminuição da acuidade visual, tendo sido encontrada uma associação entre as variáveis escolaridade ($p < 0,001$) e idade ($p < 0,001$). **Conclusões:** O Teste de Snellen é relevante para a saúde pública, uma vez que, embora não substitua o exame oftalmológico, é uma forma validada, simples e prática de identificar possíveis alterações na condição visual dos indivíduos, auxiliando no rastreio de possíveis deficiências na acuidade visual.

Palavras-chave: Acuidade visual; Optometria; Promoção da saúde escolar; Saúde ocular.

INTRODUCTION

The epidemiology of visual impairments is alarming. The World Health Organization (WHO) estimates that around 19 million school-aged children and adolescents have some visual impairment, with 80% of the cases being treatable or preventable.[1] The Brazilian Council of Ophthalmology (CBO) reports that about 20% of students have ophthalmological alterations, and approximately 10% of preschool students need treatment for refractive errors.[1] According to the Brazilian Institute of Geography and Statistics (IBGE), the prevalence of blindness is approximately 24% in Brazil. Therefore, the International Agency for the Prevention of Blindness estimates that about 29,000 children are blind due to visual impairments that could have been diagnosed and treated earlier.[2]

Vision is responsible for most of the sensory information an individual receives from their environment, making it crucial for communication.[2] Visual acuity (VA) refers to the ability of the eye to distinguish shapes and details of objects. Therefore, visual health is essential for learning processes. Ophthalmological examination enables the evaluation of VA and the identification of refractive errors, playing a crucial role in the early detection of diseases and prevention of childhood blindness.[1,2]

The Brazilian Ministry of Health Ordinance No. 3,128/2008 established that state-level care networks for individuals with visual impairment must include care-related actions. Paragraph 1 of Article 1 of the Ordinance defines an individual with visual impairment as someone with a low vision or blindness. Individuals with reading difficulties often face learning challenges, which can affect their potential. In this context, the Brazilian Ministry of Health developed guidelines for ocular healthcare in childhood aimed at early detection and prevention of visual impairments. Meanwhile, the Brazilian Ministry of Education and the Brazilian Council of Ophthalmology launched a national campaign for visual rehabilitation using the Snellen chart, acknowledging the importance of vision in the school learning process.

The School Health Program (*Programa Saúde na Escola [PSE]*) aims to evaluate the health status of children and adolescents enrolled in schools located within the coverage areas of family health teams. Ophthalmological examination is one of the initiatives included in the PSE. Therefore, prevention and early detection of visual impairments should be conducted by primary healthcare services through the basic health units (BHU), which are the main point of entry into the Brazilian Unified Health System (SUS).

Therefore, evaluating VA of children is fundamental for physical and psychosocial development and may be done through an easy-to-perform and reliable ophthalmological examination method. This evaluation enables early diagnosis of visual alterations and timely referral for specialized evaluation.[2]

For that reason, this study aimed to evaluate the VA of young students from an education institution in the municipality of Paulista, Pernambuco, Brazil, using the Snellen chart, and to refer those with reduced VA to specialized ophthalmological examination via the BHU.

METHODS

This quantitative cross-sectional study was conducted from May to September 2023 with students from the *Creche Escola Nossa Senhora do Ó*, located in the municipality of Paulista, Pernambuco. The school has 216 students from preschool to elementary school, with 96 aged between one and five years and 120 between 6 and 17 years.

Inclusion criteria included students enrolled in the school, with authorization from parents or legal guardians by signing the informed consent and assent forms, and those aged between 3 and 17 years old.

Students with health conditions preventing from participation in data collection, absent from school during data collection, under three years old, with incomplete questionnaires, and without consents were excluded.

The school administration distributed the consent forms to parents or legal guardians. On a scheduled date, researchers informed guardians and children or adolescents (aged 7 to 18

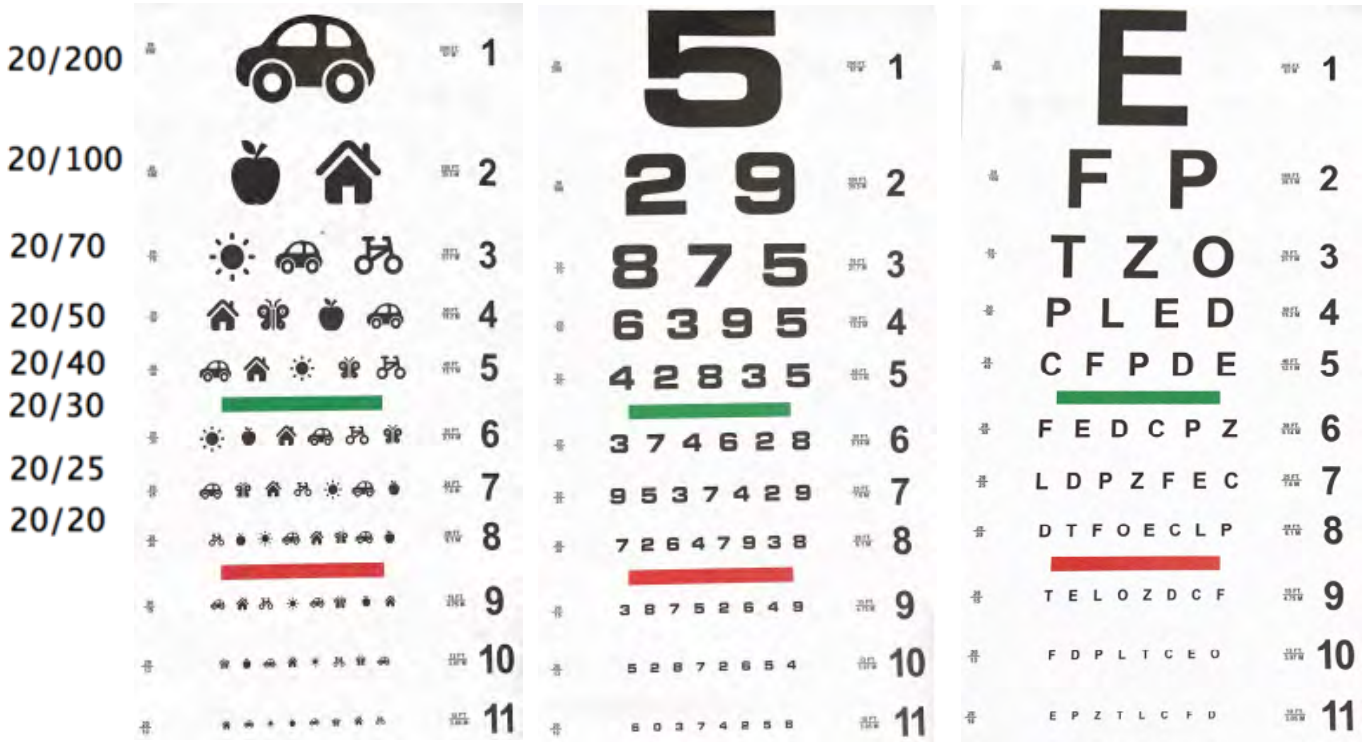
years) about the procedures and obtained their decision regarding participation. Once accepted and signed, data collection began with a preliminary interview with the student or guardian, followed by the application of the Snellen chart.

Two validated instruments were used for data collection: (1) a standardized questionnaire containing student information and (2) the Snellen chart for assessing VA.[1,3] The questionnaire included demographic characteristics (name, age, sex, and educational level), use of glasses or contact lenses, self-perception of vision, and the Snellen chart results.

The Snellen chart was developed in 1862 by Dutch ophthalmologist Herman Snellen and is used as a global standard for VA evaluation, recommended by the CBO.[3] In this study, letter and figure charts were used according to the age and educational level of the students.

Data collection and evaluation was conducted in a reserved room at the school, with an mean duration of ten minutes for each student. The examiners were undergraduate students, previously trained and qualified.

The Snellen chart test was conducted in a quiet, well-lit, and glare-free environment. Students were positioned six meters from the Snellen chart (Figures 1 - 3), which was set up 1.5 meters above the ground with standardized dimensions. Students who wore glasses or contact lenses kept them on during the test, which was conducted one eye at a time. The examiner pointed to letters or figures and asked students to identify them, starting from top to bottom (i.e., from largest to smallest optotypes).[4]



Figures 1, 2, and 3. Snellen chart (letters, numbers, and figures).
Source: images captured from banners provided by Hoya Vision.

VA is expressed as a fraction. The numerator refers to the distance at which the tested eye sees an object, and the denominator the distance a normal eye sees the same object. Thus, a larger denominator indicates a lower VA.

If the student could correctly read the optotypes from row eight of the chart, their VA was considered normal, represented as 20/20 (i.e., the ability to see clearly at six meters). Decreased VA was considered when the student could not read this row, and the level of impairment depended on the row with the smallest optotypes the student could see clearly. The recorded VA was the fraction of the last row in which the student correctly identified more than half of the optotypes.

A total of 123 students were included and analyzed, and 93 students were excluded: 13 were absent from school during data collection, two had incomplete questionnaires, 45 did not sign the consent forms, and 33 were under three years old.

The sample was stratified by sex (male or female), educational level (preschool or elementary), vision self-perception (good, poor, or don't know), and use of glasses or contact lenses (yes or no). Then, students were divided into group D (decreased VA) or group N (normal VA).

All data were tabulated in an Excel 365 spreadsheet and analyzed using SPSS (v25.0, IBM Corp., Chicago, Illinois, USA). Statistical tests were applied with a 95% confidence level. The results were calculated based on valid responses; blank or missing responses were not included. The Kolmogorov-Smirnov test was used to check the normality of quantitative variables. Results were presented in tables and figures with absolute and relative frequencies. Numerical variables are expressed as measures of central tendency and dispersion. The Chi-square test and Fisher's exact test were used to evaluate associations of categorical variables. The Mann-Whitney test was used to compare two groups of non-normal distributions.

The study was conducted in collaboration with the Francisco Marcelo Dias BHU in Paulista, which received a list of students with reduced VA for referral to specialized ophthalmological consultation.

RESULTS

The mean age of the students (n = 123) was 7.7 ± 3.4 years, with a median of 7.0 years (IQR 5 - 11) and an age range from 3 to 15 years. Regarding sex, 42.3% (n = 52) were male and 57.7% (n = 71) female. In terms of educational level, 48.0% (n = 59) were in preschool and 52% (n = 64) in elementary school.

Regarding visual self-perception, 65.2% (n = 60) of the students perceived their vision as good, while 34.8% (n = 32) perceived it as poor. Only 2.4% (n = 3) of the students wore glasses or contact lenses, while 97.6% (n = 120) did not. Table 1 describes the sociodemographic and clinical characteristics of the sample.

Table 1. Sample sociodemographic and clinical characteristics (n = 123).

Variables	N	%
Sex		
Male	52	42.3
Female	71	57.7
Educational level		
Preschool	59	48.0
Elementary school	64	52.0
Self-perceived vision		
Good	60	65.2
Poor	32	34.8
Glasses or contact lenses		
Yes	3	2.4
No	120	97.6

	Mean ± SD	Median (IQR 25; 75)	Min – Max
Age (years)	7.7 ± 3.4	7.0 (5.0; 11.0)	3.0 – 15.0

Source: Authors.

Regarding the VA evaluation, 66.7% (n = 82) of the total sample had decreased VA (group D) and 33.3% (n = 41) had normal VA (group N) (Figure 1).

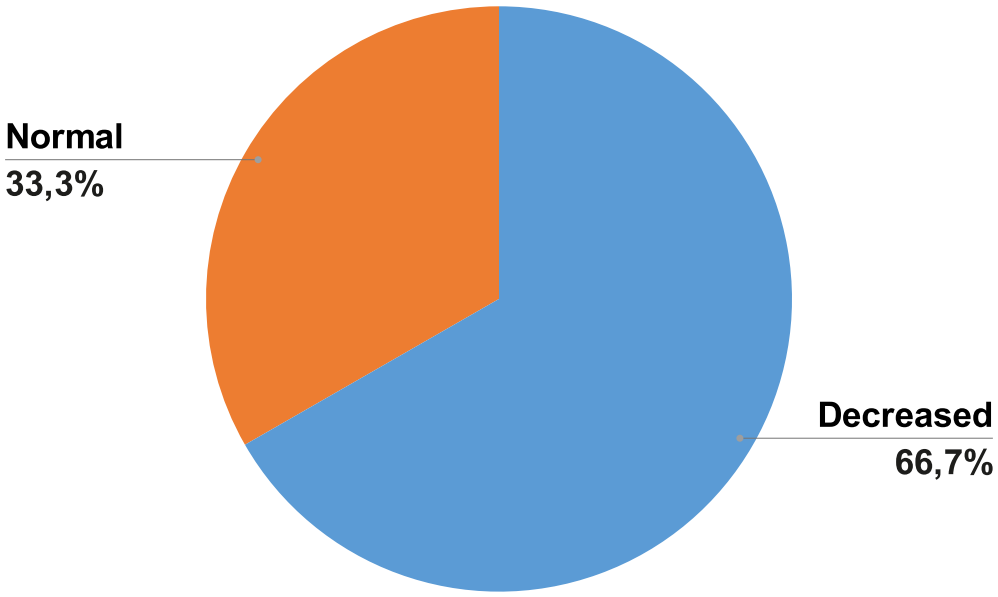


Chart 1. Visual acuity.

Among the students in group D, the mean age was 6.1 ± 2.6 years; 65.4% (n = 34) were male and 67.6% (n = 48) were female. For educational level, 98.3% (n = 58) were in preschool and 37.5% (n = 24) were in elementary school. Regarding vision self-perception, 68.3% (n = 41) reported good vision, while 56.2% (n = 18) perceived it as poor. Additionally, 33.3% (n = 1) reported wearing glasses or contact lenses, while 67.5% (n = 81) did not (Table 2).

Table 2. Visual acuity stratified by sex, educational level, self-perceived vision, and use of glasses/contact lenses.

Variables	Visual acuity		p-value
	Group D Decreased n (%)	Group N Normal n (%)	
Sex			
Male	34 (65.4)	18 (34.6)	0.769 [A]
Female	48 (67.6)	23 (32.4)	
Educational level			
Preschool	58 (98.3)	1 (1.7)	**< 0.001** [A]
Elementary school	24 (37.5)	40 (62.5)	
Self-perceived vision			
Good	41 (68.3)	19 (31.7)	0.250 [A]
Poor	18 (56.2)	14 (43.8)	
Glasses/lenses			
Yes	1 (33.3)	2 (66.7)	0.257 [B]
No	81 (67.5)	39 (32.5)	
	Mean ± SD	**Mean ± SD**	
Age (years)	6.1 ± 2.6	10.6 ± 2.2	**< 0.001** [C]

(A) Chi-square test; (B) Fisher's exact test; (C) Mann-Whitney test.

For students in the group N, the mean age was 10.6 ± 2.2 years; 34.6% (n = 18) were male and 32.4% (n = 23) female. For educational level, 1.7% (n = 1) were in preschool and 62.5% (n = 40) were in elementary school. Regarding vision self-perception, 31.7% (n = 19) reported good vision and 43.8% (n = 14) perceived it as poor. Additionally, 66.7% (n = 2) reported wearing glasses or contact lenses, while 32.5% (n = 39) did not (Table 2).

Educational level and VA were significantly correlated ($p < 0.001$). Specifically, decreased VA was more prevalent among preschool students than elementary school students. Additionally, age also showed a statistically significant difference in VA ($p < 0.001$) between students with decreased and normal VA.

DISCUSSION

The ability to distinguish shapes and details of objects (i.e., VA) plays a key role in human growth and development.[11] The Snellen chart is one of the most practical, sensitive, and low-cost tools used for early visual function evaluation in children,[12,13] considering the impact of VA on quality of life and learning.

Recent studies reported a high prevalence of reduced VA in school-aged children. Authors highlight the need for ocular health prevention in the public health system and the implementation of new strategies for continuous and effective measures to prevent blindness and other vision-related problems.[13,14]

In the present study, 60 students (65.2%) considered their vision as good, whereas 32 (34.8%) judged it as poor. These results differ from those found by Fernandes & Franzoi,[15] in which 61% of children reported a negative self-perception of their vision quality.

However, this study identified reduced VA in 82 (66.6%) of the children and adolescents. This value exceeds the 20.4% estimated by Carneiro *et al.*[16] in children who have difficulty seeing at long distances. Our data also contrasts with the frequencies reported by Mombelli *et al.*[17] (16.8%) and Gomes *et al.*[18] (29%).

Moreover, a discrepancy of 68.3% was observed between students who self-reported good vision and those who were later identified as having reduced VA. However, the study by Procópio, Takahashi, and Souza et al.[3] reported that most children judged their vision as good either because they had few symptoms or could not relate their complaints to visual impairments.

Regarding sex, our study found that 48 girls (67.6%) and 34 boys (65.4%) had decreased VA. The prevalence among females corroborates the data from Procópio, Takahashi, and Souza et al.[3], who investigated 287 children and adolescents. However, no statistically significant sex-related differences were found among the 503 students investigated by Martins *et al.*[19].

In terms of educational level, 98.3% of children in elementary school (1st to 5th grade) showed visual impairments, compared to 37.5% in middle school (6th to 9th grade). This finding contrasts the results of Santos, Tarja, and Torres[13], who suggested that younger children present lower rates of visual impairments. Nevertheless, Wu *et al.*[20] argued that the prevalence of reduced VA among younger students is increasing progressively.

According to Feller *et al.*[21], visual impairments often go unnoticed before school age because young children engage in fewer activities that require prolonged visual focus. Supporting this perspective, Gomes *et al.*[18] highlighted that the beginning of school increases visual demands for tasks such as reading and writing.

In this context, Feller *et al.*[21] highlighted the importance of teachers attention to early signs of visual impairments. In the qualitative research, teachers expressed awareness of the need for

specialized follow-up in some situations; however, they reported challenges such as lack of support from the children's families and limitations within the PSE.

Although our study did not directly investigate the relationship between visual impairment and academic performance, Martins *et al.*[19] found no statistical difference in school performance between students with normal and reduced VA. On the other hand, Faria *et al.*[22] and Suzuki Junior *et al.*[22] reinforced the idea that uncorrected refractive errors can directly hinder knowledge acquisition and may contribute to school dropout and grade retention.

CONCLUSION

This study showed that two-thirds of the students had reduced VA, with a significant association with educational level and age. These findings highlight the importance of considering these factors when evaluating and intervening in ocular health and for future studies.

Since visual impairments directly impact the learning process of young students, this study supports the evaluation of VA as a public health priority via the Snellen chart. Furthermore, it facilitates the early detection of potential visual impairments, improving quality of life and health conditions.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

DBL: Writing – original draft, Writing – review and editing. **ASS:** Data curation, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review, and editing. **LFRS:** Writing – original draft, Writing – review and editing. **PTFGV:** Writing – original draft, Writing – review and editing. **THFC:** Writing – original draft, Writing – review and editing. **DMFS:** Writing – original draft, Writing – review and editing. **SCAP:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review and editing.

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