

# School performance: visual acuity interference

## *Desempenho escolar: interferência da acuidade visual*

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### ABSTRACT

**Objective:** We intend to evaluate the prevalence of visual disorders among 8 to 10-year-old students from a public school in Pouso Alegre, state of Minas Gerais, as well as verify the possible legitimacy of the correlation between a poor school performance and some kind of visual deficit. **Methods:** We conducted a transversal and quantitative study whose target were the students enrolled in the elementary course (2<sup>nd</sup> to 4<sup>th</sup> grade) of Pio XII Municipal School in the academic year of 2009. We examined the students' visual acuity using Snellen optometric chart and investigating their report card. **Results:** We assessed 201 children. In what concerns visual acuity, 11.4% of the sample showed altered visual acuity. When we analyzed their Mathematics grades, we observed that the students with visual deficit had grades significantly lower than those ones with normal acuity ( $p = 0.032$ ). We did not notice any statistical significance in the comparison between their Portuguese grades during this initial sorting out. **Conclusion:** This study demonstrated that a non-identified visual disorder may interfere in child school performance.

**Keywords:** Visual acuity; Underachievement; Visual disorders; School health; Eye health; Child development; Child

### RESUMO

**Objetivo:** Avaliar a prevalência de distúrbios visuais em alunos de 8 a 10 anos de idade em uma escola pública no município de Pouso Alegre, Minas Gerais, e verificar a possível legitimidade da correlação entre um baixo desempenho escolar e algum tipo de déficit visual. **Métodos:** Estudo transversal e quantitativo realizado em alunos matriculados de 2<sup>a</sup> a 4<sup>a</sup> série na Escola Municipal Pio XII durante o ano letivo de 2009. Foram realizados o exame de acuidade visual com o uso da Escala optométrica de Snellen e a análise do boletim escolar. **Resultados:** Foram avaliadas 201 crianças. Quanto à acuidade visual, 11,4% da amostra apresentou acuidade visual alterada. Na análise das notas de Matemática, foi observado que os alunos que tinham déficit visual apresentaram notas significativamente menores que aqueles sem déficit ( $p=0,032$ ). Não se observou significância estatística na comparação das notas de português dos alunos com e sem déficit durante a triagem inicial. **Conclusão:** Este estudo demonstrou que um distúrbio visual não diagnosticado pode interferir no desempenho escolar infantil.

**Descritores:** Acuidade visual; Baixo rendimento escolar; Distúrbios visuais; Saúde escolar; Saúde ocular; Desenvolvimento infantil; Criança

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## INTRODUCTION

“The eye is the window of the human body through which it feels its way and enjoys the beauty of the world” (Leonardo da Vinci). It is known that 85% of man’s contact with the world occurs through sight<sup>(1)</sup>. Sight is essential for learning and is responsible for most of the sensory information we receive from the outside world<sup>(2)</sup>. Given the speed of growth and development of the eye, children are more vulnerable to visual disorders<sup>(3)</sup>. Up until school age, visual impairment may go unnoticed by parents and family members, as children at home are not aware that they cannot see well, since they do not perform activities which require a visual effort. This is made worse mainly because of the lack of periodic eye tests<sup>(4)</sup>.

Visual impairment in childhood can hinder learning and socialisation, affecting the development of motor skills, cognition and language during the sensitive years of a child’s development<sup>(5,6)</sup>.

Ophthalmic disorders are the 3<sup>rd</sup> most frequent cause of health problems among school children, and visual impairment is closely linked to school performance. Almost no Brazilian schoolchildren have had an eye test. Less than 10% of children starting school have had a previous eye test<sup>(7)</sup>.

The World Health Organisation (WHO) estimates that around 7.5 million schoolchildren have some kind of visual impairment and only 25% of them experience symptoms; the other three quarters would need a specific test to identify the problem<sup>(2)</sup>. According to the Brazilian Council of Ophthalmology, 10% of primary school pupils need eyesight correction due to refractive errors: hyperopia, myopia and astigmatism. Of these, around 5% have severely reduced visual acuity, i.e. an impairment greater than 50% compared to normal eyesight<sup>(8)</sup>.

According to a survey by the *Alfabetização Solidária* (Solidarity in Literacy) programme<sup>(9)</sup>, visual impairment is a public health issue which is responsible for 22.9% of school dropouts in Brazilian primary education.

It is important to identify visual impairment in pre-school and school age children, as it interferes with the child’s learning process and psychosocial development<sup>(10)</sup>. It is at this age that the eye’s development is completed, therefore it is much easier to resolve any problems in order to reduce or even avoid the consequences of visual impairment.

It has also been noted that the cost of implementing programs for detecting low visual acuity and preventing ophthalmic problems in developed countries is far lower than treating people with eye disorders<sup>(11)</sup>.

Routine visual acuity tests aim to ensure good visual health, reduce the high rates of school dropouts and school failure, and prevent a wider range of eye complications<sup>(6)</sup>.

This study aims to assess the prevalence of visual impairment among pupils aged 8-10 years in a public school in the municipality of Pouso Alegre and to examine the possible correlation between poor school performance and visual impairment of any kind.

## METHODS

This was a cross-sectional quantitative study which included primary-school pupils at the Municipal School Pio XII in the municipality of Pouso Alegre, Minas Gerais, during the 2009 school year. All 381 pupils from the 2<sup>nd</sup> to the 4<sup>th</sup> year of primary

education were invited to take part in the study. Of these, 94 were outside the appropriate age group for the study (8 to 10 years old). 86 were not given authorisation by their caretakers through an Informed Consent form and were therefore excluded. A total of 201 pupils were assessed.

The study complies with Resolution 196/96, which standardises studies in humans, and received prior authorisation by the institution. After approval by the UNIVAS Ethics Committee under protocol n° 1016/09 and once the participants’ caretakers had signed the Informed Consent form, the Snellen optometric scale was individually applied by the researchers at the time and date specified by the institution. A trained examiner took note of last line in Snellen’s chart read without difficulty by each participant, i.e., the best visual acuity for each eye. Visual acuity above 0.7 was considered normal, and lower values were defined as impaired visual acuity, in accordance with WHO criteria. Pupils who were unable to read the 8<sup>th</sup> line of the chart were referred to a specialist for diagnosis and treatment.

A comparative analysis of school performance was then carried out between pupils who had some sort of visual impairment and those with normal eyesight, based on school reports.

Statistical analysis was performed using the non-parametric Mann-Whitney test.

## RESULTS

A total of 201 children were assessed. Of these, 59 were in 2<sup>nd</sup> year primary, 68 in 3<sup>rd</sup> year and 74 in 4<sup>th</sup> year (Table 1). 56.2% were boys (Table 2). When asked about how they assessed their own eyesight, 103 children (51.2%) said they could see well, 32 (15.9%) mentioned a visual impairment and 66 (32.8%) were unable to classify their eyesight (Table 3). 61.7% mentioned they experienced headaches (Table 4).

Upon examination, 23 children (11.4% of the sample) had changes in visual acuity (Tables 5, 6 and 7). The pupils with impaired visual acuity values were referred to the ophthalmology outpatient unit of Hospital Samuel Libânio (HCSL). Of these, 8.7 did not turn up to any of the three scheduled consultations, and among those that did, 33.3% had a confirmed diagnosis of low visual acuity and were prescribed eyeglasses (Table 8).

Analysis of the participants’ performance in maths showed that visually-impaired pupils had significantly lower marks than those with normal vision ( $p=0.032$ ). Analysis of performance in Portuguese language showed no statistically-significant differences between the two groups.

The average mark was 30.34 (out of 45) for Portuguese and 29.10 (out of 45) for maths. Among pupils with impaired visual acuity according to Snellen’s test, the average mark was 28.52 (out of 45) for Portuguese and 25.83 (Out of 45) for maths.

Pupils who did not report headaches had average marks of 31.30 for Portuguese and 30.27 for maths, while those who did report headaches had average marks of 29.41 and 27.77, respectively.

## DISCUSSION

The assessment of a child’s ocular health should be part of the paediatric examination. Assessing and detecting possible visual impairments should be done as early as possible given that the longer the delay, the lower the chance of correction and recovery. In addition, visual impairment contributes to poor

**Table 1**

**Sample distribution based on school year and age**

Age	Série			Total
	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	
8	59	0	0	59
9	18	47	3	68
10	5	28	41	74
Total	82	75	44	201

Source: Socio-demographic questionnaire

**Table 2**

**Sample distribution based on gender**

Gender	N	%
Male	113	56,2
Female	88	43,8
Total	201	100

Source: Socio-demographic questionnaire

**Table 3**

**Sample distribution based on self-assessment of visual acuity**

Visual Acuity	N	%
Sees well	103	51,2
Cannot see well	32	15,9
Does not know	66	32,8
Total	201	100

Source: Socio-demographic questionnaire

**Table 4**

**Sample distribution based on the presence of headaches**

Headaches	N	%
No	77	38,3
Yes	124	61,7
Total	201	100

Source: Socio-demographic questionnaire

**Table 5**

**Sample distribution based on visual impairment according to Snellen's test**

Visual Impairment	N	%
No	178	88,6
Yes	23	11,4
Total	201	100

Source: Socio-demographic questionnaire

**Table 6**

**Distribution of children without visual impairment based on age and gender**

Age	Gender		Total
	Male	Female	
8	23	25	48
9	42	20	62
10	36	32	68
Total	101	77	178

**Table 7**

**Distribution of children with visual impairment based on age and gender**

Age	Gender		Total
	Male	Female	
8	6	5	11
9	4	2	6
10	2	4	6
Total	12	11	23

**Table 8**

**Distribution based on prescription of eyeglasses by the ophthalmologist**

Prescription of eyeglasses	N	%
No	14	66,7
Yes	7	33,3
Total	21	100

Source: Socio-demographic questionnaire

school performance and socialisation and is related to changes in the child's emotional and psychological state<sup>(11)</sup>.

The prevalence of impaired visual acuity found in this study (11.4%) is in agreement with data from the municipality of São Carlos (11.9%) as well as the results from a study conducted in Canada, which varied between 10.5% and 13.8%<sup>(13,14)</sup>.

With regard to performance in Portuguese language, there was no statistically-significant difference between pupils with normal visual acuity and those with impaired visual acuity ( $p=0.183$ ), even for the best marks among the group with satisfactory visual acuity.

The pupils without any visual impairment had the best marks in maths, and the difference was statistically significant ( $p=0.032$ ).

Although it is well known that visual impairment, especially refractive errors, does not usually cause headaches in children, pupils who did experience headaches had significantly lower marks for both subjects ( $p=0.010$  for Portuguese and  $p=0.018$  for maths).

## CONCLUSION

This study confirms that undiagnosed visual impairment can interfere with school performance.

Treating and correcting eye disorders and, therefore, promoting visual efficiency creates conditions favourable to improved school performance.

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