# OPHTHALMIC SCREENING REGARDING THE LIGHTING EFFECT ON VISUAL FUNCTION

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Keywords: natural lighting, artificial lighting, visual system, ophthalmological clinical parameters **Abstract:** This research aims to provide data on natural and artificial lighting in rural and urban schools and their impact on students. The purpose of the study is to follow-up of the modifications of the visual system of the pupils in relation to different lighting conditions. We have pursued the appreciation of natural and artificial lighting in different points of the classroom taking into consideration the orientation of the building in relation to the light (maximum reception of the light). The ophthalmological clinical parameters studied are: modifications of the anterior pole, visual acuity, strabismus deviation, apparition of subjective manifestations characteristic for the adaptation astenopia, refractometry and optical correction. At the same time, we have pursued the arrangements of the banks within the classrooms.

Cuvinte cheie: iluminat natural, iluminat artificial, aparat visual, parametri clinici oftalmologici **Rezumat:** Această cercetare și-a propus să furnizeze date despre iluminarea naturală și artificială în școlile din mediul rural și urban și impactul asupra elevilor. S-au urmarit modificărilor aparatului vizual la copilul școlar în funcție de diverse condiții de iluminat. S-a urmărit, deasemenea, aprecierea iluminatului natural și artificial în diverse puncte din încăpere în funcție de orientarea clădirii față de lumină (recepția maximă a luminii). Parametrii clinici oftalmologici urmăriți sunt: modificările polului anterior, acuitatea vizuală, deviația strabică, apariția manifestărilor subiective caracteristice astenopiei acomodative, refractometrie, corecția optică. S-a urmărit totodată amplasarea băncilor în sălile de clasă.

# INTRODUCTION

This research aims to provide data on natural and artificial lighting in rural and urban schools and the impact on students. Operation is subject to the visual apparatus primarily quantitative and qualitative characteristics of its physiological excitant - light.

#### THE AIM OF THE STUDY

The scope of the study is the follow-up of the modifications of the visual apparatus of pupils in relation to different lighting conditions.

Due to the fact that the specialty literature presents numerous inconvenient and namely insufficient lighting conditions, we have proposed to be informed on the lighting degree in schools and the effects on pupils by analysing a number of 21 schools of Vaslui County, out of which 17 of them belong to the rural environment and 4 to the urban one. The pupils included in this study are comprised are between 6 and 19 years old.

#### MATHERIAL AND METHOD

The prospective study is on 5 years (2002-2007). The number of pupils registered within the schools where I have performed measurements of the light intensity is between 7.117, out of which 3.361 are boys and 3.756 girls, 2.017 are in rural area 5.100 in urban area.

The determinations of the light intensity have been performed with MARVEL lux meter series L632277 in conditions of incandescent natural and artificial lighting and in the afternoon according to the schedule of pupils. We have followed the appreciation of natural and artificial lighting in different points of the classroom taking into consideration the orientation of the building in relation to the light (maximum reception of the light).

We have taken into consideration a lot of 270 pupils from different schools and high schools of rural and urban area considered as representative in order to reduce the error factor and to correspond to the exigencies of the lots recommended by sanitary statistics.

270 pupils, 145 boys and 125 girls, 118 from the rural area and 152 from the urban area have been ophtalmologically tested.

The ophthalmological clinical parameters studied are: modifications of the anterior pole, visual acuity, strabismus deviation, apparition of subjective manifestations characteristic for adaptation astenopia, refractometry and optical correction. At the same time, we have followed the arrangements of banks within classrooms; 215 classrooms, 95 of them in rural area and 120 in urban area taking into consideration the windows and type of light.

# RESULTS

#### Refraction defects

They represent a frequent cause of visual acuity accompanied by head aches during school activities. In children, insufficient vision is discovered during ocular examination (hypermetropia, myopia, astigmatism).

Following the measurements performed, we have noted the presence of refraction defects and of strabismus in a

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number of 57 pupils. For the *age group between* 7 - 11 years old, several refraction vices were registered in a number of 16 pupils, 10 boys and 6 girls from the rural area (5) and urban area (11). The most frequent refraction defect was hypermetropia registered in a number of 6 pupils and myopia in a number of 3 pupils. Functional strabismus was present in 5 pupils, myopic astigmatism was present in 3 cases, hypermetropic astigmatism in 3 cases and mixed astigmatism was registered in 1 case. Adaptation astenopia was registered in 9 pupils especially in the case of those from rural area where lighting of classrooms is an incandescent light. Irritations related to conjunctivitis and blepharitis were registered in 12 pupils.

Figure no. 1. Ocular affections.	Age group of 7 - 11 years
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For the *age group between 11-15 years old*, 12 pupils presented refraction vices, 5 boys and 7 girls, 8 from the rural area and 14 from the urban area. Hypermetropia registered in a number of 4 pupils, myopia in a number of 2 pupils, strabismus was present in 3 cases, adaptation astenopia in 9 cases and irritations related to conjunctivitis and blepharitis were registered in 10 pupils.

Figure no. 2. Ocular affections. Age group of 11-15 years





Figure no. 3. Ocular affections. Age group of 15-19 years

For the *age group between 15-19 years old*, 17 pupils presented refraction vices, 7 boys and 10 girls, 7 from the rural area and 10 from the urban area. Hypermetropia registered in a number of 5 pupils, myopia in a number of 2 pupils and mixed astigmatism in 2 pupils. Strabismus was present in 4 cases, adaptation astenopia in 10 cases. Irritations related to conjunctivitis and blepharitis were registered in 14 pupils.

# **Ophthalmological clinical examination**

The study was performed on a number of 270 pupils from several schools with ages between 7 and 19 years old. The pupils were chosen at random from rural and urban areas,  $1^{st}$  and

12<sup>th</sup> grades from different schools and high schools. The examination of the pupils was performed in the Policlinic of Vaslui in conditions of fluorescent lighting.





The statistical data suggest the fact that more refraction defects are met in pupils from urban area. Adaptation astenopia was most frequently met in pupils from rural area due to insufficient lighting conditions existent in classrooms, to insufficient lighting at their home or, in some cases to the lack of electricity (I specify the fact that many of the schools where I have performed the measurements still use incandescent artificial lighting).

The prescription of corresponding glasses during the examination of the pupils who presented refraction defects has emphasized the necessities that they had from the point of view of the refraction and have explained to a great extent the cause of the visual fatigue accused and the presence of objective phenomenon of irritation related to conjunctivitis.

From the refraction defects registered, hypermetropia and myopia were the most frequent; the first one was registered in 15 pupils and the second in 9 pupils. Hypermetropic astigmatism was registered in 10 pupils and adaptation astenopia in 28 pupils. Irritations related to conjunctivitis and blepharitis were registered in 36 pupils.

In order to emphasize the importance to prescribe corresponding glasses in the case of the pupils examined, we have followed the modification of the frequency of certain subjective and objective ocular symptoms observed.

The prescription of corresponding glasses led to a decrease of subjective ocular symptoms, improved the vision in the case of pupils who presented refraction defects.

#### DISCUSSIONS

The age of the pupils examined is comprised between 6 and 19 years old. The majority of the cases investigated presented emmetropia, and namely 149 pupils representing 55,2%. The most frequent refraction defects were the following: hypermetropia - 15 cases (5,6%); myopia - 9 cases (3,3%), hypermetropic astigmatism -10 cases (3,7%); myopic astigmatism - 7 cases (2,6%); mixed astigmatism - 4 cases (1,5%). The deviations related to strabismus (the most frequent were esotropias) were registered in 12 cases (4,4%). Irritation related to conjunctivitis accompanied by that of the cilia was registered in 36 pupils (13,3%). The symptoms of adaptation astenopia were met more frequently in schools from rural area where the schools had incandescent or deficient lighting. The lack of light filtering and adaptation astenopia were elements which increase ocular discomfort. We met 28 cases of adaptation astenopia (10,4%).

# Comparative studies

Similar results were obtained in Sweden and the USA.

Gothenburg University has conducted a study, which was approved by the Ethics Committee of the institution. After entering a school for children of the pre-school classes for six years in Sweden, responsibility for preventive health care system for this age group was transferred from the health centers

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for children in school health services and vision testing was introduced at the age of 6 years. (Bib.No.1).

At the University of Georgia the study was conducted on "The influence of school facilities on student achievement" after which it was established that lighting, color choices and windows play an important role in the student performance (Bib.No.2).

# CONCLUSIONS

An appreciable number of children/pupils who present refraction defects result from the study performed, as follows: Hypermetropia (5,6%), Myopia (3,3%), Hypermetropic astigmatism (3,7%), Myopic astigmatism (2,6%), Mixed astigmatism (1,5%), Deviations related to strabismus (esotropias) (4,4%).

Ophthalmologic screening decreases the percentage of refractive, strabismus or mixed amblyopia. Medical education in relation to the ophthalmologic exam must be performed by including the latter in the National Health Program. Ocular infections or inflammations are more frequent in schools which do not have corresponding hygiene conditions. Sufficient lighting would reduce pupils' problems related to vision.

When lighting the classrooms, one must permanently take into consideration the necessity to increase the intensity of the fluorescent light in comparison with incandescent light in order to maintain the chromatic qualities of fluorescent lighting and the visual comfort required.

By means of the researches performed with the lux meter in 5 years I have noted the high level of fluorescent lighting in comparison with the incandescent one in the schools where the latter still existed. The lack of periodic control of the lighting level with the help of a lux meter and especially the defective exploitation of light sources has lead to this severe depreciation of lighting with unfavourable consequences on visual comfort.

In some schools where incandescent lighting was changed to fluorescent lighting, some children who presented refraction defects accused visual fatigue.

In order to restore a convenient visual environment for the development of the school activity, it was necessary to increase the intensity of fluorescent lighting by supplementing he number of fluorescent lamps in order to turn to yellow having refractivity properties to emmetropia.

In the case of the children whose visual acuity and ocular refraction were measured, we have noted their correction after wearing corresponding glasses and after increasing the light intensity. One part of the children presented phenomenon such as: eye irritations (blepharitis, conjunctivitis and eyesore) and others presented symptoms of visual fatigue.

A great number of the pupils examined accused visual fatigue phenomenon in the first months from the introduction of fluorescent lighting in schools where incandescent lighting was used; after 6 months the percentage of the pupils who complained about this phenomenon decreased to less than 50%. This fact emphasizes the adaptation possibilities of human body to new environment conditions. Other pupils present visual fatigue when using incandescent lighting. The cause of this deficiency was the low lighting level. The children who presented visual fatigue in the conditions of natural lighting were those with uncorrected refraction defects.

Lack of regular review by Lux lighting level and especially the exploitation of the poor lighting sources that led to a large depreciation of track lighting impacts on the visual comfort.

It was intended to follow the location of the banks related to classroom windows and the type of lighting. In this

regard it was suggested changing the number of rows of benches in classes where they were each four times.

It is noted that the lighting intensity is higher in Eastern-oriented classrooms, decreases in intensity in the rooms facing north, intermediate values being obtained in the West and South facing rooms.

Also notice that the light intensity decreases from banks located near the window to the banks in raw two and three both in natural light and mixed lighting (incandescent artificial and natural).

It was found an increase in school performance in children with refraction correction and children studying in schools where the system was changed from incandescent to fluorescent lighting.

Placing the light sources in relation to students is important. In the classroom students should be placed in banks so as not to look directly into light. Students should be allowed to define the amount of light which gives a maximum visual comfort and function. It is recommended focal illumination, controlled by the child, such as a lamp table.

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