

# Character of Changes of the Absolute and Relative Amounts of the Main Populations of Immune-Competent Cells of the Peripheral Blood of Children with Visual Impairments

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## Abstract

The purpose of the study was to investigate the nature of changes of the absolute and relative numbers of major populations of immune-competent cells of peripheral blood of children with visual impairment aged 7-10 years.

We surveyed 63 children at the age of 7-10 years, including children with visual impairments (14 boys and 17 girls) an average age of whom is  $8.48 \pm 0.13$  years, and practically healthy peers with normal vision (16 boys and 16 girls) an average age of whom is  $8.53 \pm 0.13$  years.

Whole blood was selected to study the level of adaptive stress, cellular reactivity of the body of children with visual impairments. Blood for general analysis was taken not from the finger, so as not to disturb the sensory mechanisms (sense of touch) of sensitivity of children with disabilities, but from the elbow vein. Blood tests were carried out by well-known and accepted methods worldwide.

It is established that in children with visual disorders the tendencies of increasing of absolute and relative number of ICCs are formed, involved in realization of nonspecific anti-infective protection, as well as increasing of absolute number of lymphocytes and decreasing of relative number of lymphocytes and monocytes. Also, it is established that absolute number of leukocytes in the peripheral blood of girls is dominated by the absolute number of leukocytes in boys with vision impairment - by 9.12% ( $P < 0.05$ ), the relative number of eosinophils - by 39.86% and ESR - by 13.34%.

**Keywords:** Children; Visual Impairment; ICC (Immune-Competent Cells); Pathology

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## Introduction

### Formulation of the Problem in General

One of the most relevant in modern physiology and pathological physiology is the problem of individualization of adaptive reactions of the body of almost healthy children and children suffering from certain diseases and diseases states (people with vision pathology) to various stimuli, diseases and certain conditions [1-3].

The immune component and adaptive reactions are present in the development of any pathology, because the immune system is a critical target for the negative effects of external and internal pathogenic factors. In the first stages of the disease immunological changes are diagnostic, and then they become pathogenetic. Pathogenetic mechanisms of adaptation of the body of the child in the state of visual impairment and blindness, environmental conditions, physical, mental and psychological load are provided by his reserves, including the

immune system. Among the types of immunity are species (hereditary, congenital, nonspecific) and acquired (adaptive), which is the specific immunity determined by the stability, stability of the absolute and relative numbers of the main populations of immune-competent cells (ICC), the level of adaptive voltage, the level of adaptation voltage, cellular and immunological reactivity to various environmental factors and conditions of the body. The leading place in hereditary and immune protection belongs to the population of neutrophilic polymorphonuclear leukocytes (granulocytes), which form a reactive response in the formation of adaptation processes, cellular and immunological reactivity of the organism [3,4-9].

In the light of above mentioned, it was considered necessary to analyze the absolute and relative number of major populations of immune cells in the peripheral blood of children with vision pathology, adaptive capacity of the body, immuno-hematological indices, as integral indicators of cellular and general immunological protective reactivity [2,3,6,7,10,11].



The blood system plays a leading role in ensuring adaptive activity, cellular reactivity, immune cell responsiveness, and immunological reactivity. This powerful role is determined, first of all, by its function of transporting nutrients and oxygen - the main sources of energy for cells and tissues [1,5,6,9].

The blood system is also one of the most important carriers of information on processes that are carried out at the level of tissue structures, and immune cells (IKC) of the blood are extremely sensitive to changes in the external environment and internal state (disease, impaired function, etc.). Therefore, the first stage of the research work was to study the absolute and relative number of major populations of peripheral blood immune cells (IR) in children aged 10-16 years with vision impairments.

### Formulating the Goals of the Article

The aim of the study was to study the nature of changes in the absolute and relative number of major populations of immune-competent cells of peripheral blood of children with visual impairment aged 7-10 years.

### Material and Research Methods

The studies were conducted on the basis of the Sloviansk specialized boarding school I-III degrees no. 23 and the comprehensive school no. 17 in Sloviansk, Donetsk region.

Given the changes in mental capacity at the beginning of the working day and week, the studies were performed on days of high mental capacity - on Tuesday, Wednesday, and Thursday from 09.00 to 11.00 in the morning, when the optimal level of physiological functions is observed.

We surveyed 63 children aged 7-10 years, including children with visual impairments (14 boys and 17 girls) of an average age of  $8.48 \pm 0.13$  years, and practically healthy peers with normal vision (16 boys and 16 girls) of an average age  $8.53 \pm 0.13$  years.

Whole blood was selected to study the level of adaptive stress, cellular reactivity of the body of children with visual impairments. Blood for general analysis was taken not from the finger, so as not to disturb the sensory mechanisms (sense of touch) of sensitivity of children with disabilities, but from the elbow vein. Blood tests were carried out by well-known and accepted methods worldwide.

The obtained results were processed using MUSTAT.12 applications. The reliability of the data for the independent samples is calculated by the t criterion student (when distributing arrays close to normal). The difference was considered significant at  $P > 0.05$ .

The work was carried out in accordance with biotic standards in compliance with the relevant laws of Ukraine.

### Results and Discussion

To determine the informative dynamics of changes of indicators of the absolute and relative number of major populations of IKC and other cells of the immune system, as possible prognostic factors for the formation of vision impairments in children, the degree of impairment of all indicators was determined.

The absolute and relative numbers of major immune cell populations are sexually dependent, that's why we have established absolute and relative numbers of major immune cell populations in peripheral blood in boys and girls with 7-10 years of age.

The first stage of the study was to study the absolute and relative number of major populations of immune-competent cells (ICC) of the peripheral blood of healthy children, aged 7-10 years, enrolled in Sloviansk special boarding school of I-III degrees no. 23 of Donetsk region (Table 1).

It is known that most indicators of absolute and relative numbers of major populations of immune-competent cells and ESR are sex dependent. For the development of differentiated remedies and rehabilitation measures for children with special needs, information is needed on the absolute and relative numbers of core ICC populations in practically healthy boys and girls (Table 2).

It is shown that according to the given indicators characterizing the absolute and relative number of the main populations of immune-competent cells of peripheral blood of practically healthy children aged 7-10 years, boys are not statistically different ( $P > 0.05$ ) from such indicators in girls. However, girls had a slightly lower absolute leukocyte quantity (3.27%) due to a decrease in the absolute number (5.01%), granulocytes, neutrophil polymorpho nuclear leukocytes (5.43%) and monocytes (14.29%), but the relative number of rod-derived neutrophilic leukocytes increased by 7.98%, eosinophilic leukocytes by 9.03%, and lymphocytes by 2.78%. All slight fluctuations (the first degree of immune disorders) of the absolute and relative number of the main populations of ICC in the peripheral blood do not conclude that girls of 7-10 years in terms of blood differ from boys. Minor changes are physiological in nature and minimal.

The next step was to determine the absolute and relative numbers of the main populations of immune-competent peripheral blood cells of children of 7-10 years with visual pathology who attend specialized boarding school for blind and partially sighted children in Sloviansk.

The results of the study of the absolute and relative number of major populations of IKC in the peripheral blood of children (boys and girls) aged 7-10 years with vision pathology are shown in Table 3, with the

**Table 1:** Absolute and relative numbers of major immune-competent cell populations in healthy children.

Immune-competent cells	Units of measurement	Practically healthy children of 7-10 years (n=30)
Leukocytes	M 10 <sup>9</sup> /l	5.59±0.40
Granulocytes	%	65.81±0.65
	M 10 <sup>9</sup> /l	3.68±0.29
Neutrophilic leukocytes	%	64.30±1.06
	M 10 <sup>9</sup> /l	3.60±0.31
Segmental neutrophils	%	61.82±0.95
	M 10 <sup>9</sup> /l	3.46±0.28
Wand neutrophils	%	2.48±0.18
	M 10 <sup>9</sup> /l	0.14±0.02
Eosinophilic leukocytes	%	1.51±0.04
Agranulocytes	%	34.42±0.13
	M 10 <sup>9</sup> /l	1.93±0.07
Lymphocytes	%	27.69±0.19
	M 10 <sup>9</sup> /l	1.55±0.18
Monocytes	%	6.72±0.08
	M 10 <sup>9</sup> /l	0.38±0.04
Erythrocytes	M 10 <sup>9</sup> /l	3.85±0.36
Hemoglobin	h/l	128.08±2.18
Color indicator	c.un.	0.97±0.03
Erythrocyte sedimentation rate	mm/h.	5.98±0.10
Average age	years	8.48±1.55

**Note:** E - erythrocytes, H - hemoglobin, CP - color index, L - leukocytes, LFC - lymphocytes, MNC - monocytes.



**Table 2:** Absolute and relative number of major populations of immune-competent peripheral blood cells in healthy children of 7-10 years.

Immune-competent cell populations	Units of measurement	Practically healthy boys (n=16)	Practically healthy girls (n=14)	The degree of immune performance in girls against boys	P
Leukocytes	M10 <sup>9</sup> /l	5.68±0.43	5.50±0.37	-I	>0.05
Granulocytes	%	66.32±0.56	65.28±0.54	-I	>0.05
	M10 <sup>9</sup> /l	3.77±0.31	3.59±0.27	-I	>0.05
Neutrophil granulocytes	%	64.88±1.09	63.71±1.03	-I	>0.05
	M10 <sup>9</sup> /l	3.69±0.37	3.50±0.25	-I	>0.05
Segmental neutrophils	%	62.50±1.02	61.14±0.87	-I	>0.05
	M10 <sup>9</sup> /l	3.55±0.31	3.36±0.25	-I	>0.05
Wand neutrophils	%	2.38±0.17	2.57±0.18	+I	>0.05
Eosinophilic granulocytes	%	1.44±0.03	1.57±0.05	+I	>0.05
Agranulocytes	%	34.31±0.13	34.52±0.12	+I	>0.05
	M10 <sup>9</sup> /l	1.95±0.09	1.90±0.08	-I	>0.05
Lymphocytes	%	27.31±0.17	28.07±0.21	+I	>0.05
	M10 <sup>9</sup> /l	1.55±0.17	1.54±0.18	-I	>0.05
Monocytes	%	7.00±0.09	6.43±0.07	-I	>0.05
	M10 <sup>9</sup> /l	0.40±0.04	0.35±0.03	-I	>0.05
Erythrocytes	M10 <sup>12</sup> /l	3.91±0.41	3.78±0.31	-I	>0.05
Hemoglobin	h/l	131.30±2.17	124.80±2.18	-I	>0.05
Color indicator	c.un.	0.98±0.03	0.90±0.02	-I	>0.05
ESR	mm/h	6.38±0.09	5.57±0.11	-I	>0.05
Average age	years	8.63±1.71	8.29±1.30	-I	>0.05

**Note:** E - erythrocytes, H - hemoglobin, CP - color index, L - leukocytes, LFC - lymphocytes, MNC - monocytes.

**Table 3:** Absolute and relative numbers of major populations of immune-competent peripheral blood cells of children with visual impairments at the age 7-10.

Immune-competent cell populations	Units of measurement	Children (boys and girls) with pathology of vision (n=31)	Practically healthy boys and girls (n=30)	The degree of immunological disorders	P
Leukocytes	M10 <sup>9</sup> /l	5.96±0.12	5.59±0.40	+I	>0.05
Granulocytes	%	66.68±3.63	65.81±0.56	+I	>0.05
	M10 <sup>9</sup> /l	3.94±0.29	3.68±0.20	+I	>0.05
Neutrophilic leukocytes	%	64.96±2.32	64.30±1.06	+I	>0.05
	M10 <sup>9</sup> /l	3.87±0.25	3.60±0.36	+I	>0.05
Wand neutrophils	%	2.65±0.18	2.48±0.18	+I	>0.05
	M10 <sup>9</sup> /l	0.16±0.02	0.14±0.021	+I	>0.05
Segmented neutrophils	%	62.31±2.18	61.82±0.95	+I	>0.05
	M10 <sup>9</sup> /l	3.71±0.23	3.46±0.33	+I	>0.05
Eosinophils	%	1.72±0.14	1.51±0.04	+I	>0.05
Agranulocytes	%	33.74±1.12	34.42±0.13	-I	>0.05
	M10 <sup>9</sup> /l	2.01±0.11	1.93±0.07	+I	>0.05
Lymphocytes	%	27.34±0.79	27.69±0.19	-I	>0.05
	M10 <sup>9</sup> /l	1.63±0.10	1.55±0.18	+I	>0.05
Monocytes	%	6.40±0.29	6.72±0.08	-I	>0.05
	M10 <sup>12</sup> /l	0.38±0.05	0.38±0.04	-	-
Erythrocytes	M10 <sup>12</sup> /l	3.85±0.30	3.85±0.36	-	-
Hemoglobin	h/l	126.57±3.27	128.08±2.18	-I	>0.05
Color indicator	c.un.	0.94±0.01	0.97±0.03	-I	>0.05
ESR	mm/h.	6.48±0.25	5.98±0.10	+I	<0.05
Average age	years	9.16±2.10	8.48±1.55	-	>0.05

**Note:** E - erythrocytes, H - hemoglobin, CP - color index, L - leukocytes, LFC - lymphocytes, MNC - monocytes.

subsequent definition of these indicators separately in girls and boys (Table 3).

Obtained and shown in table 3, the results of the study of the absolute and relative number of the main populations of ICC peripheral blood of children aged 7-10 years with vision pathology indicate minor (first-degree disturbance) changes in the above mentioned indicators. The absolute and relative numbers of major CKI populations that characterize nonspecific innate immunity of children tend to increase.

At the same time, the absolute number of total pool of leukocytes increases - by 6.62%, granulocytes - by 8.15% at the expense of growth

of the absolute number of neutrophilic granulocytic leukocytes - by 7.50%, segmented nuclear neutrophilic leukocytes - by 7.23%, and also increases the relative number of granulocytes - by 1.32%, neutrophilic leukocytes by 1.03%, segmental neutrophils - by 0.80%, rod-neutrophilic leukocytes - by 6.85%, eosinophilic leukocytes - by 9.55%.

Among immune-competent cells that form adaptive immunity, there are various directional changes in both absolute and relative numbers of ICC agranulocyte lines. In all cases there is a tendency to decrease the relative number of agranulocytes - by 2.02%, lymphocytes - by 1.28% and monocytes - by 5.0%. However, what is important is a



tendency to increase the absolute number of agranulocytes - by 4.15% due to the increase in the absolute number of lymphocytes - by 5.16%, but the absolute number of monocytes does not change.

There is a tendency for an increase in erythrocyte sedimentation rate (ESR) in children aged 7-10 years with vision pathology. ESR is a nonspecific general reaction that may indicate an inflammatory pathology. Determination of ESR, together with measurement of body temperature, calculation of absolute and relative amount of ICC are included in the list of obligatory methods of examination of sick and practically healthy people, children.

The changes in ESR depend, first of all, on the intensity of formation of erythrocyte aggregates, which are related to the properties of the plasma and the charge of the erythrocyte membrane. ESR increases with the shift of the protein spectrum toward coarse-dispersed proteins, in particular by increasing the amount of fibrinogen - the main stabilizer of erythrocytes, as well as immunoglobulins, increasing the number of other globulins, accompanied by a decrease in the electric charge of erythrocytes and contributing to their aggregation.

There is a close relationship between an increase in immunoglobulin concentration and an increase in ESR. ESR depends on the amount, size, volume of erythrocytes, the concentration of hemoglobin in them. ESR in women is higher than in men. An increase in ESR may outstrip other changes in the system of diseases and pathological conditions over time. All of these were the basis for ESR in children aged 7-10 years with vision pathology. It has been shown that ESR in children with visual impairments tends to increase by 8.36%.

As indicated above, according to our and literature data, individual indicators (magnitude of eosinophils, monocytes, and ESR) of peripheral blood have sex differences. Therefore, for the development of exercise for children aged 7-10 years with vision impairments, information is needed on the absolute and relative numbers of the major populations of peripheral blood ICD, ESR, the absolute number of erythrocytes, hemoglobin in children and separately in boys and girls with vision impairments.

The results of the study of the absolute and relative numbers of the main populations of peripheral blood ICC in boys aged 7-10 years with vision impairments are shown in Table 4.

The comparative characteristics of the absolute and relative number of the main populations of peripheral blood ICC in boys aged 7-10 years with vision pathology showed the formation of a tendency to increase the absolute number of leukocytes, granulocytes by 1.86%, neutrophilic granulocytes - by 1.63%, segmental neutrophils 1.41% and the relative number of granulocytes by 1.46%, neutrophilic leukocytes by 1.51%, rod-shaped neutrophils by 13.87%.

Such slight changes in the absolute and relative numbers of granulocyte lines of leukocytes testify to the activation of immune-competent cells (granulocyte sprout), which form the leading factors and mechanisms of innate immunity in boys aged 7 - 10 years with vision pathology. Their growth is characterized by the stimulation of nonspecific (innate) immune protection and the reduction of ESR by 5.11%.

Against this background, there is a tendency for a slight ( $P > 0.05$ ) decrease in the absolute number of agranulocytes - by 2.03%, lymphocytes and monocytes - by 8.11%, as well as the relative number of these immune-competent cells - agranulocytes by 2.85%, lymphocytes - by 1.68% and monocytes - by 7.69%. These data indicate

**Table 4:** Absolute and relative numbers of major populations of immune-competent peripheral blood cells in boys with visual impairments at 7-10 years of age.

Indicators	Units of measurement	Practically healthy boys (n=16)	Boys with vision pathology (n=14)	Degree of immune disorders	P
Leukocytes	M10 <sup>9</sup> /l	5.68±0.43	5.70±0.11	+I	>0.05
Granulocytes	%	66.32±0.56	67.29±1.77	+I	>0.05
	M10 <sup>9</sup> /l	3.77±0.31	3.84±0.27	+I	>0.05
Neutrophil granulocytes	%	64.88±1.09	65.86±1.47	+I	>0.05
	M10 <sup>9</sup> /l	3.69±0.37	3.75±0.22	+I	>0.05
Segmented neutrophils	%	62.50±1.02	63.14±1.27	+I	>0.05
	M10 <sup>9</sup> /l	3.55±0.31	3.60±0.21	+I	>0.05
Wand neutrophils	%	2.38±0.17	2.71±0.17	+I	>0.05
		0.14±0.02	0.15±0.02	+I	>0.05
Eosinophilic leukocytes	%	1.44±0.03	1.43±0.11	-I	>0.05
Agranulocytes	%	34.31±0.13	33.36±1.17	-I	>0.05
	M10 <sup>9</sup> /l	1.95±0.09	1.90±0.09	-I	>0.05
Lymphocytes	%	27.31±0.17	26.86±0.87	-I	>0.05
	M10 <sup>9</sup> /l	1.55±0.17	1.53±0.08	-I	>0.05
Monocytes	%	7.00±0.09	6.50±0.26	-I	>0.05
	M10 <sup>9</sup> /l	0.40±0.04	0.37±0.05	-I	>0.05
Erythrocytes	M10 <sup>12</sup> /l	3.91±0.41	3.91±0.31	-	-
Hemoglobin	h/l	131.30±2.177	128.43±3.49	-I	>0.05
Color indicator	c.un.	0.98±0.03	0.92±0.01	-I	>0.05
ESR	mm/h	6.38±0.09	6.07±0.22	-I	>0.05
Average age	years	8.63±1.71	9.14±2.11	+I	>0.05

**Note:** E - erythrocytes, H - hemoglobin, CP - color index, L - leukocytes, LFC - lymphocytes, MNC - monocytes.

that boys with vision disorders do not form a specific immune response (immune inflammation) and ESR is reduced by 5.11%.

Thus, in boys aged 7-10 years with vision pathology there is a tendency to increase of indicators (immune-competent cells), which testifies to the activation (the first level of stimulation of ICC) of factors and mechanisms of nonspecific reactivity of the organism, and factors and mechanisms of specific acquired reactivity of immune indicators in healthy boys aged 7-10 years.

The results of the study of the absolute and relative number of major populations of peripheral blood ICC girls from 7-10 years of age with vision impairments in a comparative aspect with almost healthy girls are shown in table 5.

Both boys aged 7-10 years with vision impairments and girls of the same age with vision impairments have a tendency to increase the absolute number of leukocytes - by 13.09% due to an increase in the concentration of granulocytes - by 14.48%, including neutrophilic granulocytes - by 13.71% due to mature forms (segmented neutrophils) - by 13.69%.

At the same time, there is a tendency to increase the relative number of the total pool of granulocytes - by 1.19%, neutrophilic leukocytes, segmented and rod-shaped neutrophils. The relative number of eosinophilic leukocytes increased significantly ( $P < 0.05$ ) by 27.39%.

Despite a slight ( $P > 0.05$ ) decrease in the relative number of agranulocyte leukocytes forming a specific immune defense, their absolute number tends to increase in children with visual impairments - the total absolute number of agranulocytes increases - by 11.58%, the number of lymphocytes - by 12.34% and monocytes - by 11.43%.

Multiple directional changes in the absolute and relative number of major ICC populations, including granulo and agranulocyte



**Table 5:** Absolute and relative numbers of major populations of immune-competent peripheral blood cells of girls with visual impairments at the age of 7-10 years.

Indicators	Units of measurement	Practically healthy girls (n=16)	Girls with vision pathology (n=17)	Degree of immunological disorders	P
Leukocytes	M10 <sup>9</sup> /l	5.50±0.37	6.22±0.13	+I	>0.05
Granulocytes	%	65.28±0.54	66.06±1.49	+I	>0.05
	M10 <sup>9</sup> /l	3.59±0.27	4.11±0.31	+I	>0.05
Neutrophilic leukocytes	%	63.71±1.03	64.03±1.17	+I	>0.05
	M10 <sup>9</sup> /l	3.50±0.25	3.98±0.27	+I	>0.05
Segmented neutrophils	%	61.14±0.87	61.47±1.08	+I	>0.05
	M10 <sup>9</sup> /l	3.36±0.25	3.82±0.25	+I	>0.05
Wand neutrophils	%	2.57±0.18	2.59±0.19	+I	>0.05
		0.14±0.02	0.16±0.02		>0.05
Eosinophilic leukocytes	%	1.57±0.05	2.00±0.16	+I	<0.05
Agranulocytes	%	34.52±0.12	34.11±1.07	-I	>0.05
	M10 <sup>9</sup> /l	1.90±0.08	2.12±0.12	+I	>0.05
Lymphocytes	%	28.07±0.21	27.82±0.71	-I	>0.05
	M10 <sup>9</sup> /l	1.54±0.18	1.73±0.11	+I	>0.05
Monocytes	%	6.43±0.07	6.29±0.31	-I	>0.05
	M10 <sup>9</sup> /l	0.35±0.03	0.39±0.04	+I	>0.05
Erythrocytes	M10 <sup>12</sup> /l	3.78±0.31	3.79±0.29	-	>0.05
Hemoglobin	h/l	124.86±2.18	124.71±3.05	-	>0.05
Color indicator	c.un.	0.96±0.02	0.95±0.01	-	>0.05
ESR	mm/h.	5.57±0.11	6.48±0.24	+I	<0.05
Average age	years	8.29±1.39	9.16±2.10	+I	>0.05

**Note:** E - erythrocytes, H - hemoglobin, CP - color index, L - leukocytes, LFC - lymphocytes, MNC - monocytes.

leukocytes, lead to changes in blood aggregate of children aged 7-10 years with vision impairments manifested in an increase in erythrocyte sedimentation rate, but remains at 16.34% this indicator is in the area of normal ESR type.

In virtually healthy children, as shown above, individual indicators of absolute and relative numbers of the major populations of peripheral blood ICC (eosinophils, ESR, etc.) depend on gender. Therefore, an attempt was made to establish the absolute and relative numbers of the main populations of peripheral blood ICC in children aged 7-10 years with vision impairments (Table 6).

It is shown that the absolute number of leukocytes in the peripheral blood of girls prevails the absolute number of leukocytes in boys with visual impairments - by 9.12% (P <0.05), the relative number of eosinophils - by 39.86% and ESR - by 13.34%.

In girls aged 7-10 years with vision impairments there is a tendency to increase the absolute number of granulocyte leukocytes - by 7.03%, neutrophilic leukocytes - by 6.18%, segmented neutrophils - by 6.11% and decrease in the relative number of neutrophilic leukocytes - by 2.81%, segmented nuclear neutrophils by 2.72%, rod-shaped neutrophils by 4.63%.

However, girls have an absolute and relative number of agranulocytes - by 11.58% and 2.25% respectively, lymphocytes - by 13.07% and 3.57% respectively, the absolute number of monocytes - by 5.41% and decreased by 3.34% relative number of monocytes. Girls have a tendency to decrease the absolute number of erythrocytes - by 3.17%, hemoglobin - by 2.98%, but the tendency to increase of color index - by 3.27%.

## Conclusion

Thus, in girls aged 7-10 years with vision impairments, compared

**Table 6:** Absolute and relative numbers of major populations of immune-competent peripheral blood cells of children with visual impairments aged 7-10 years, depending on the sex.

Indicators	Units of measurement	Boys (n=14)	Girls (n=17)	Children (boys and girls) (n=31)	P
		M±m	M±m	M±m	
Leukocytes	M10 <sup>9</sup> /l	5.70±0.11	6.22±0.13	5.96±0.12	<0.05
Granulocytes	%	67.29±1.77	66.06±1.49	66.68±1.63	>0.05
	M10 <sup>9</sup> /l	3.84±0.27	4.11±0.31	3.98±0.29	>0.05
Agranulocytes	%	33.36±1.17	34.11±1.07	33.74±1.12	>0.05
	M10 <sup>9</sup> /l	1.90±0.09	2.12±0.12	2.01±0.10	>0.05
Neutrophilic leukocytes	%	65.86±1.47	64.06±1.17	64.96±1.32	>0.05
	M10 <sup>9</sup> /l	3.75±0.22	3.98±0.27	3.87±0.24	>0.05
Segmented neutrophils	%	63.14±1.27	61.47±1.08	62.31±1.18	>0.05
	M10 <sup>9</sup> /l	3.60±0.21	3.82±0.25	3.71±0.23	>0.05
Wand neutrophils	%	2.71±0.17	2.59±0.19	2.65±0.18	>0.05
		0.15±0.02	0.16±0.02	0.16±0.02	>0.05
Eosinophils	%	1.43±0.11	2.00±0.16	1.72±0.13	<0.05
Lymphocytes	%	26.86±0.87	27.82±0.71	27.34±0.79	>0.05
	M10 <sup>9</sup> /l	1.53±0.08	1.73±0.11	1.63±0.09	>0.05
Monocytes	%	6.50±0.26	6.29±0.31	6.40±0.27	>0.05
	M10 <sup>9</sup> /l	0.37±0.05	0.39±0.04	0.38±0.04	>0.05
Erythrocytes	M10 <sup>12</sup> /l	3.91±0.31	3.79±0.29	3.85±0.30	>0.05
Hemoglobin	h/l	128.43±3.49	124.71±3.05	126.57±3.27	>0.05
Color indicator	c.un.	0.92±0.01	0.95±0.01	0.94±0.01	>0.05
ESR	mm/h.	6.07±0.22	6.88±0.27	6.48±0.24	<0.05
Average age	years	9.14±9.11	9.18±2.09	9.16±2.10	>0.05

**Note:** E - erythrocytes, H - hemoglobin, CP - color index, L - leukocytes, LFC - lymphocytes, MNC - monocytes.

to the same age boys with vision pathology, an increase in the absolute number of total pool of leukocytes, relative number of eosinophils and ESR is established, as well as a tendency to increase the absolute number of granulocytes, neutrophil leukocytes, segmental leukocytes, agranulocytes, lymphocytes and monocytes and the relative number of lymphocytes, agranulocytes.

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