REPORT

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Impact of the academic performance grades on the blood picture in female students

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Abstract

The paper presents the blood picture patterns in female students with different average academic performance grades in their record book. An improvement in the academic performance of female students is accompanied by a significant decrease in the concentration of neutrophils, a significant increase in the level of lymphocytes and minor changes in other blood parameters. Thus, the level of neutrophils experiences a gradual decrease, reaching its minimum of 57.7% (P <0.02) in girls who has performance grade A and 66.2 in case of grade C. The number of lymphocytes in girls with the highest academic performance grades in the record book is recorded to be 33.6% (P <0.05), while in those with the minimum acceptable performance grade it is found to be 26.1%.

The level of platelets increases up to 320.8 thousand per microliter (mcL) of blood in the girls with academic performance grade B, decreases to 296.4 in case of grade A, and it is reported to reach 287.0 for those with academic performance grade C.

Keywords

Academic performance, Erythrocytes, Hemoglobin, Leukocytes, Platelets

Imprint

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Introduction

The quality of life of students is the main indicator of their health status. Higher educational institutions are responsible not only for training highly qualified graduates, but also for maintaining and improving their health.

The results of studies carried out in recent years demonstrate an increase in occurrence rates of various health disorders among students. Thus, the percentage of students with unsatisfactory health status is recorded to be in the range from 10 to 40% [1]. Studying at the university, new knowledge is acquired.

Acquiring of new knowledge by students stems from the formation of skills and abilities. The factors that determine the career growth of a higher school graduate are the level of his/her expertise, skills and abilities.

Academic success of a student is determined by the depth of the knowledge and skills he/she has acquired within the framework of the required educational standard. The main goal of the university's activities today is to raise the level of educational services. Due to the fact that the main objective of the individual's activity is the full realization of his/her capabilities, the biggest challenge in our time is to achieve the highest academic performance in the students.

The academic performance is the student's capability to acquire the training material and use, if necessary, of the skills and knowledge acquired in mastering the educational program.

On o f the studies on issues of the academic performance has been undertaken by T.V. Gadaya, N.F. Talyzina, B.G. Ananyeva, Yu.V. Bratchikova and Yu.A. Samarina. They have demonstrated that the complex of the factors like the functional state of the body systems and the conditions created in the educational process are decisive for the success of the student's educational activity.

It is known that mental work has the following features: high tension of the central nervous system and a high rate of the mental processes.

The state of the human intelligence is the main marker, which is deciding for a success both in education and in any kind of activity.

The results of studies both of Russian and foreign researchers demonstrate that the academic performance depends on the characteristics of the individual, the level of the initial background knowledge and adaptive features of the human organism. Researchers have established a direct relationship between the person's mental abilities and his/her active state. The

person's abilities determine his/her capabilities in the implementation of any activity, and at the same time his/her active state is a factor, which forms and develops his/her skills.

The educational activity is one of the variants of the mental work, the essence of which is the proper acquisition, storage and use/implementation of a considerable amount of the relevant information.

Exposure to a high information load for a long time can reduce the functional reserves of the human body and affect the human health condition [2].

The learning environment determines both the mental success and the actual academic performance. The state of the functional systems in the student's body also depends on the conditions of the learning environment.

When organizing the educational activities, universities shall decide on those means and methods that would best contribute not only to improving the mental performance, but also to strengthen health in their students.

Only the presence of good memory and high-focused attention is the key to success in mental activity. The fact that there is a direct relationship between the mental work and the state of the body physiological systems has been noted in [3, 4]. The increased physical and mental loading taken by the central nervous system and the cerebral cortex has a significant impact on such mental processes as attention, memory, thinking and others.

The state of the student's body systems is influenced by such factors as prolonged sitting position, the impact of stresses of various origins, negative emotions, a high pace of work with a shortage of time under anxiety because of the final result to be achieved.

Since the value of the graduate training on the labor market is determined by his/her successful academic performance in his/her studies at the university, which depends on the state of the body systems, investigations devoted to the blood system state in female students with different academic performance grades should be treated as a topical issue.

Therefore, the purpose of our study is to identify and assess the blood picture in female students with different academic performance grades.

Materials and methods

To study the blood picture in female students with different academic performance grades, we conducted our research in the Human Physiology Laboratory with involvement of the Research Testing Equipment Sharing Center at the Chechen State University.

32 clinically healthy female students of the full-time education participated in our research. Their age ranged from 18 to 21 years.

Depending on their academic performance, the girls were divided into several groups. Each group consisted of 7 to 14 female students. The reference group consisted of the girls with average grade C in their record book.

Full blood count was performed in every participant in our research using MEK7222K Hematology Analyzer manufactured by Nihon Kohden (Korea).

Statistical processing of the obtained research data was carried out with the Biostatistics software.

Results and discussion

The results of the conducted study of blood count data in the female students with different academic performance grades at the university are shown in Table 1 and in Figures 1 and 2 given herein.

From the data given in the above Table and Figures, it can be concluded that the values of the average indicators in the female student groups are within the physiological norm.

It may be deduced that with an improvement in the academic performance of the female students, the concentration of neutrophils in blood significantly decreases, the level of lymphocytes significantly increases, while the other indicators in question do not undergo significant changes [5, 6].

Thus, the level of erythrocytes in blood of the girls having "good" and "excellent" grades is lower by 0.4 and 0.2 million per mcL, and that of hemoglobin decreases by 12.5 and 10.1 g/L, respectively, against those with the academic performance grade "satisfactory". The concentration of leukocytes in blood of the girls with the highest average grade in the record book is lower by 0.5 thousand in mm^3 of blood, and that recorded in the girls with the "good" grades is higher by 0.6, than in those who have grade "satisfactory.

The concentration of neutrophils in blood in the female students having grade B is found to be lower by 1.7%, and that in the female students with the A performance grade is recorded to be reduced by 8.5 ($P < 0.02$). The level of eosinophils slightly fluctuates in both directions. Their spread between groups is reported to be 0.7%. The concentration of basophils in

Table 1
Blood picture in female students with different academic performance grades

Indicators	Average grade in the record book		
	C	B	A
Erythrocytes (million/mm^3)	4.7±0.15	4.3±0.12	4.5±0.22
Hemoglobin (g/L)	135.0±5.27	122.5±5.45	124.9±5.95
Leukocytes (thousand/mm^3)	5.9±0.42	6.5±0.50	5.4±0.31
Neutrophils (%)	66.2±1.79	64.5±1.64	57.7±1.46**
Eosinophils (%)	2.6±0.16	2.4±0.20	3.1±0.38
Basophils (%)	0.5±0.09	0.6±0.08	0.7±0.09
Lymphocytes (%)	26.1±1.74	27.7 ±1.34	33.6±1.29**
Monocytes (%)	4.6±0.61	4.8±0.47	4.9±0.52
Platelets (thousand/mm^3)	287.0±18.63	320.8±25.77	296.4±25.29

Note: **P < 0,02

the best grade students is recorded to be 0.2% higher as against in those who have the "satisfactory" grades.

The blood count of the girls with average grade A in the record book shows 7.5% (P <0.02) more lymphocytes than it is the case with the female students with academic performance grade C.

The difference between the maximum and minimum concentration of monocytes is found to be 0.3%. Their highest level is detected in the students with the excellent performance grade.

With an improvement in the academic performance, the level of platelets in the blood slightly fluctuates in both directions. So, the concentration of platelets is reported to be higher in the female students having grade B by 33.8 thousand in microliters, and it is recorded in those with grade A to be higher by 9.4 as compared with the value of 287.0 found in the girls with academic performance grade C.

The detected blood picture in the female students with different academic performance grades shows its distinctive features. The differences in the blood count data are probably caused by different conditions available in each group. An increase in the academic performance is accompanied by a rise in the mental load and a decrease in physical activity. Low physical activity initiates a decrease in the performance of the body systems.

The working capacity, the academic performance, mood, health and life expectancy of a student depend on his/her physical activity.

Metabolism rate and tissue oxygen supply demonstrate their decline with insufficient physical activity and abuse of tobacco smoking [7-9].

Obviously, a slight decrease in the level of erythrocytes and hemoglobin with an improvement in the academic performance of the female students is determined by hypodynamia and high fatigue, the causes of which are high mental stress and disturbed daily schedule.

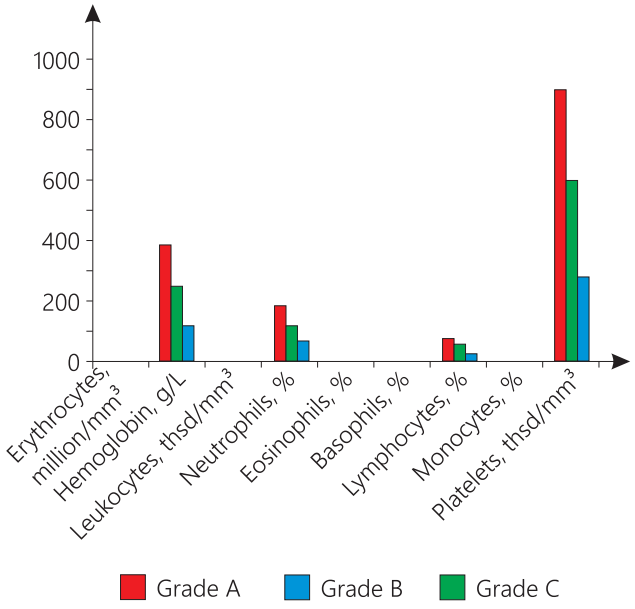

Figure 1. Full blood count data in girls with different academic performance grades

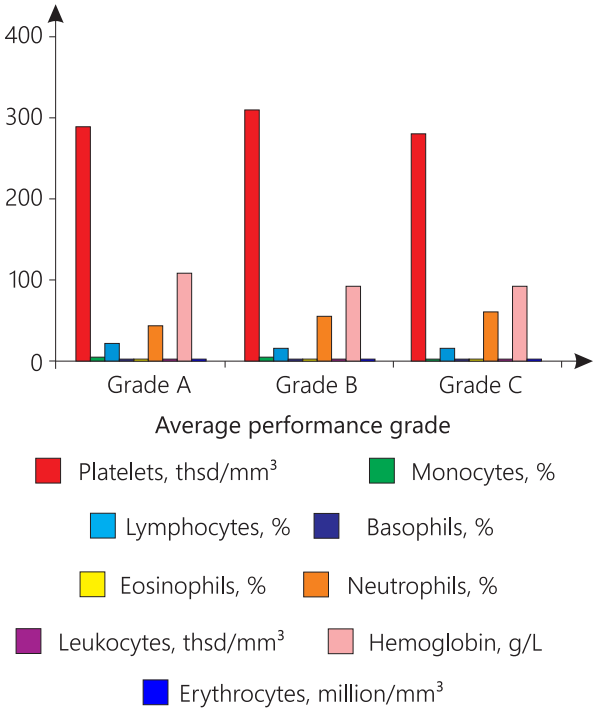

Figure 2. Dynamics of blood indicators in girls with different average academic performance

Insufficient physical activity is the reason for a decrease in the performance of the brain, the organism systems and the organism as a whole. Kalyuzhnaya R.A. [10] believes that high mental stress leads to dysfunction of the main body systems on which health depends.

According to the concept by A.A. Guminsky [11], the performance of the organs and systems in the human body is governed by the state of the muscles.

Gorinevsky V.V. [12] reports that physical inactivity inhibits development and weakens the health condition in students. The main factors triggering a drop in the functional activity of the body's vital systems, according to A.A. Artemenko [13], are low physical activity, high nervous and mental stress and disturbed daily schedule. According to J.J. Rousseau [14], movement is the fundamental condition for cognition of the surrounding world.

Low physical activity not only worsens the health condition, but also inhibits the mental performance [15], therefore high physical activity is recommended for the proper mental development.

Conclusions

We can conclude that a rise in the average grade level in the student's record book leads to a significant decrease in the number of neutrophils, a significant increase in the level of lymphocytes and minor fluctuations in both directions of other blood parameters in the female students, when analyzing the obtained blood picture patterns in the above mentioned cohorts.

In terms of our quantitative analysis we have identified the following:

- The concentration of erythrocytes in blood in the female students with academic performance grade B is lower by 0.4 million per microliter and in those with academic performance grade A by 0.2 million per microliter, as compared with the C grade group.

- The level of hemoglobin in blood in the female students having the B grades falls to 122.5 g/l, while in the A grade female students it is recorded to reach 124.9 against 135.0 in those having the C grade.

- The number of leukocytes in the groups ranges from 5.4 to 6.5 thousand per mm3.

- The concentration of neutrophils in blood in the female students with the highest average grade in the record book is 8.5% lower ($P < 0.02$) than that recorded in the girls with the minimum positive academic performance grade.

- The blood data found in the female student with the A grade show 6.5% ($P < 0.02$) more lymphocytes than it is reported in case with the C grade female students.

Statement on ethical issues

Research involving people and/or animals is in full compliance with current national and international ethical standards.

Conflict of interest

None declared.

Author contributions

The authors read the ICMJE criteria for authorship and approved the final manuscript.

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