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EVALUATION OF ECOLOGICAL PHYSIOLOGICAL STATES OF STUDENTS BY GAS-DISCHARGE VIZUALISATION METHOD

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Abstract. Nowadays, there is a need for a systematic ecobiological approach to the human body understood as a self-regulating adaptive system. Considering the multi-level structure of living organisms, a promising method is gas-discharge visualization (GDV), which allows to visualize the distribution of energy flow in biological objects and is considered the most recent approach to understanding the functioning of living organisms and identifying the state of their functional systems under the influence of various environmental factors. The article describes the mechanisms of bioelectric research, analyzes the possibilities of using the gas-discharge visualization method in environmental research. The initial data of the students studied was based on the estimation of the state of the physiological systems of their bodies depending on age and gender. In addition, the influence of socioecological factors on the physiological state of students, in particular the influence of listening to music and smoking, was estimated. It can be concluded that the GDV-visualisation method is promising in environmental studies, in particular in the human ecology, when the influence of a number of factors on the state of the organism is studied.

Keywords: gas-discharge visualisation, diagnostics, health, environmental factors, graver-gram, functional systems.

Introduction

A human is a complex biosocial being existing in close interaction with multicomponent environmental factors within a dynamic ever-changing habitat. They have a significant impact on human health and are the subject of study of a relatively young science – human ecology (Burch, Reif, & Yost, 2008; Liboff, 2010; Eder et al., 2012; Wiltschko, R. & Wiltschko, W., 2014). The analysis of the morbidity structure of human society shows that in the early 20th century prevailing infectious and other diseases were characterized by acute course; nowadays they are dominated by chronic and systemic health disorders with a number of diseases that were characteristic of the elderly, yet today they are observed in young people and even children.

Therefore, nowadays there is a need for a systematic ecobiological approach, where the human body is considered as a self-regulating adaptive system. On this basis, it is important to analyze the current psychophysiological state of a person, which allows to identify damage in the early stages and to take preventive measures against the development of the pathological processes (Deo, Itagi, Thaiyar, & Kuldeep, 2015). Such analysis can be carried out in different ways, but considering the multilevel human structure, the promising method of such research is the gas-discharge visualization (GDV) method, which allows to visualise the distribution of energy flows of biological objects and is considered not only a diagnostic method, but also a new approach to understanding the functioning of living objects (Kostyuk, Cole, Meghanathan, Isokpehi, & Cohly, 2011). Today this method is only beginning to be introduced into determination of the psycho-emotional state, the state of the physiological systems of the body. It is applied for early diagnosis of disorders of the body and the health of athletes, even in criminology (Belogorodskij, Sidorov, Yantikova, & Yanovskaya, 2004; Chesnokova, 2006; Alpatov, Sharapov, & Rotte, 2008; Hammerschlag et al., 2015).

The GDV-method is at the stage of implementation and is used to study the dynamics of the functional state of the human body. In this study, a GDV camera was used. It is a software and hardware complex, based on the visualisation and computer processing of the gas-discharge glow of organisms. The obtained GDV-grams were processed and analyzed in a specialised package of GDV-programs and allowed to carry out diagnostics of the state of functional systems of an organism. The complex is absolutely unique for monitoring the human health under the influence of various environmental factors (Korotkov, 2001, 2007; Korotkov, Matravers, Orlov, & Williams, 2010).

The subjects of the study were students aged from 16 to 22 years. The object of the research was a change in the functional state of the body under the influence of environmental factors. The purpose of the work was to analyse the current state of the systems of tissues of the human body under the influence of external factors. Objectives of the work were: 1) to conduct diagnostics of the state of physiological systems of tissues by the method of gas-discharge visualization; 2) to detect changes in the functional state of the body of students; 3) make conclusions about the health of students.

The subject of the study is relevant since currently there is an urgent need for early diagnosis of altered and pathological conditions that arise due to anthropogenic load on the human environment. The analysis of literature sources showed that research on the human body has already begun with the introduction of the of gas-discharge visualization method, but this method was not well studied and needed a wider range of use. This work addresses this issue in more detail.

Materials and methods

The GDV method consists of computer registration and analysis of glows induced by objects, including biological ones when stimulated by an electromagnetic field with an increase in the gas discharge. Parameters of a gas-discharge image depend on the properties of the object under study, and therefore there is an opportunity to draw a conclusion on the energy state of the object at a particular moment.

Characteristics of the glow of the human skin depend primarily on the activity of the autonomic nervous system. For diagnostic purposes it is convenient to use fingers. The apparatus ("BEO GDV Camera") is used to receive gas-discharge images of fingers. On the basis of BEO-grams of ten fingers, a model of the distribution of the field around the human body is constructed. Studies in different countries have shown the diagnostic significance of this approach. Parameters of a gas-discharge image depend on the properties of the studied object. Analysis of the nature of the glow induced by objects gives an opportunity to draw a conclusion about the psycho-emotional state of the object at a particular moment; thus, one can estimate the level of stress. Also, peculiarities of the organism's response to various environmental factors (changes in atmospheric air pressure, humidity, temperature, influence of smoking, various noise) are registered.

The principle of the GDV-method is computer processing based on modern mathematical methods and obtaining a conclusion for further analysis or expert evaluations (Korotkov, Williams, & Wisneski, 2004; Polushin, Levshankov, Shirokov, & Korotkov, 2009). GDV camera is a software and hardware complex based on the visualisation and computer processing of the gas-discharge glow caused. The complex consists of a hardware part ("BEO GDV Camera") and a package of specialised software GDV (GDV Software) (see Figure 1).

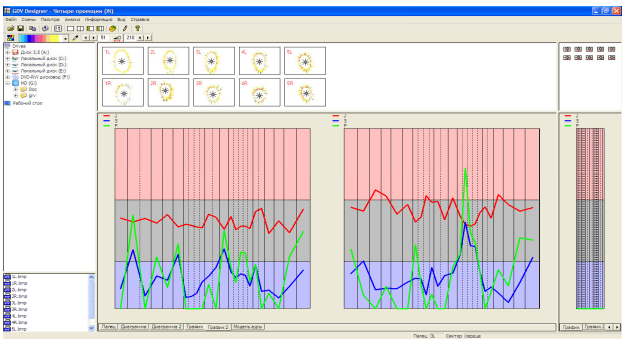

Figure 1. The main window of the program "GDV Designer"

Based on the nature of the glow, a diagnosis of the state of functional systems of the body is performed. Methodics of conducting a human study includes:

1. Receiving images of gas-discharge from ten fingers (bioelectrograms, BEO-grams) (see Figure 2).
2. Carrying out automated computer analysis of BEO-grams.

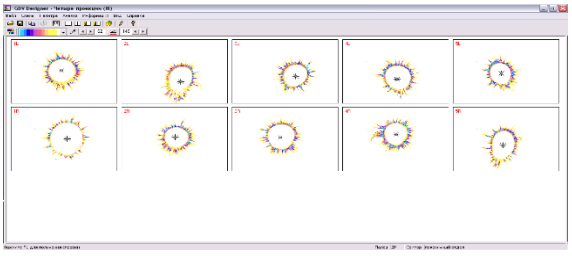

Figure 2. GDV-gram of human fingers

In GDV analysis, information about the object turns into an image due to influence on the characteristics of the discharge: intensity, duration, frequency of passage and spatial distribution of individual avalanche acts, as well as the spectral composition of radiation.

Automated computer analysis of BEO-grams includes sectoral diagnostics and parametric analysis of BEO-grams (see Figure 3).

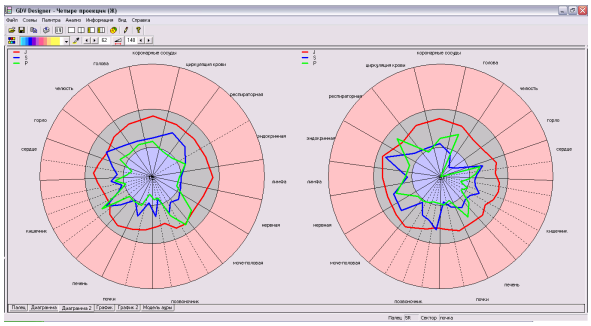

Figure 3. Sectoral analysis of GDV-grams of fingers

Sectoral diagnosis is based on a diagnostic table that links the characteristics of the luminosity of individual areas of the fingers (see Figure 4) with the functional state of tissues and systems of the body. The diagnostic table is based on the ideas of traditional Chinese medicine, the system of meridians and acupuncture points, as well as accumulated empirical experience. On the basis of BEO-grams of ten fingers, a model of the field distribution around the human body is constructed.

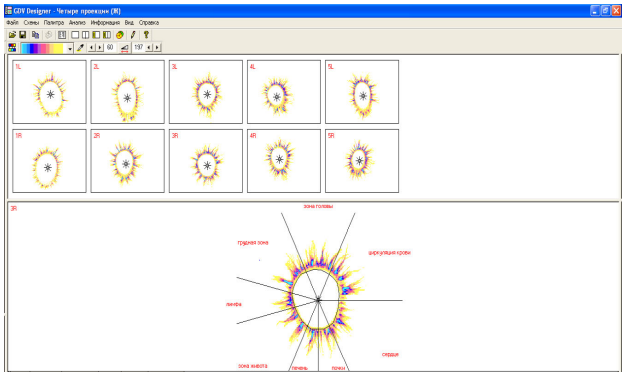

Figure 4. Screenshot of sector analysis of glow of separate areas of fingers

Studies in different countries have shown a great diagnostic value of this approach. The assessment of the body's condition by the method of GDV is carried out on the basis of the analysis of the images of GDV-grams processed by the standard program package. The conclusion from the conducted research is done by the doctor (see Figure 5).

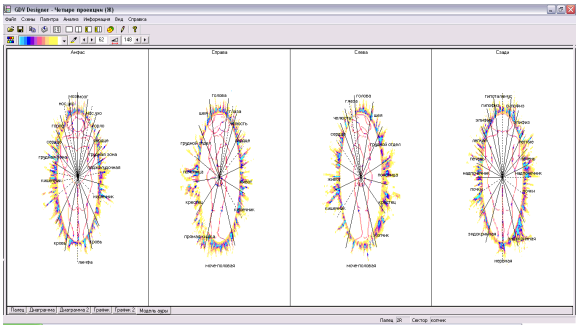

Figure 5. Screenshot of sector analysis of GDV-grams on organ projections

After the experiment, the following images and data are obtained:

- GDV-Grams of human hands with sectoral analysis and definition of problem areas ("GDV Processor"); diagrams of the energy state of human organs and systems ("GDV Diagram") – norm, hypo-, hyperfunction;
- distribution of GDV-glows around the human body ("GDV Aura");
- graphic representation of the state of energy centers of the human body – chakras ("GDV Chakras");
- numerical characteristics of GDV-Gram ("GDV Processor").

The results of the examination of patients are stored in the memory of the computer and other media. This makes it possible to compare them with dynamic observation (Korotkov, 2007).

The study involved 57 students of the first, third and fourth year. Data was obtained directly before and after classes in the beginning of the week and at the end of the week. The following factors were taken into account: age, gender, the presence of bad habits, the duration of sleep, hours spent at the computer, sports, favorite music styles and the level of perceived complexity of studying. All these factors were analysed and taken into account when conducting a general analysis of data obtained in this study.

Results and discussion

Analysis of the initial data of the students studied

All participants were interviewed using a questionnaire for a detailed study of all factors that had an impact on their health. The analysis was conducted taking into account such factors: gender, age, sports, the presence of bad habits, the duration of sleep, musical taste, assessment of the complexity of the educational process, meteosensitivity,

time spent at the computer. These factors allowed us to evaluate the general characteristics of the organism and associate them with the data obtained from GDV-grams. Specific study objects were 10 people who smoked directly before taking measurements, and 10 people who listened to their favorite music within 30 minutes before taking off of impressions. This made it possible to evaluate the influence of these factors on the human body. The study involved 57 students aged from 16 to 22 years. The students' age structure is presented in Figure 6.

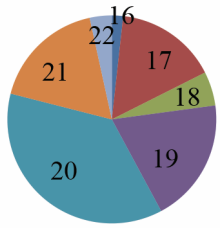

Figure 6. Age composition of the studied students (years)

Most students (73.75%) had the age range of 19–21, of which 37% were females and 63% males. Smokers accounted for 33.3% (among all young men smoking boys were 16%, among all young women smoking girls were 33%). Most boys (64%) were engaged in sports, whereas girls accounted for less than a half (43%). 38.1% of girls were meteosensitive, and these were girls aged 20–21 years; among boys, 16.7% were meteosensitive and fell within the age range from 17 to 22 years old. The duration of sleep of most of the students (93%) was 6–8 hours (see Figure 7).

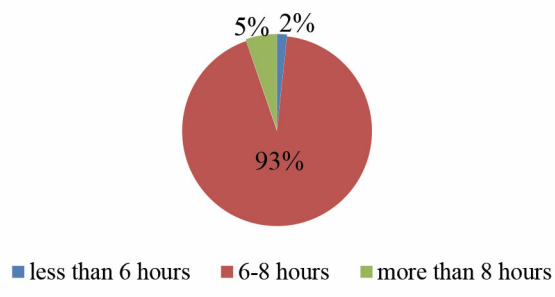

Figure 7. Duration of students' sleep

All the girls who participated in the study had a sleep duration of 6–8 hours. One of ten young men had a lower or greater sleep duration. As can be seen from Figure 8, most students (65%) spent one to four hours at the computer, and they were representative of all age groups. Less than one hour was spent by students aged 19–22, and more than four hours were spent by every fourth aged between 17 and 20 years.

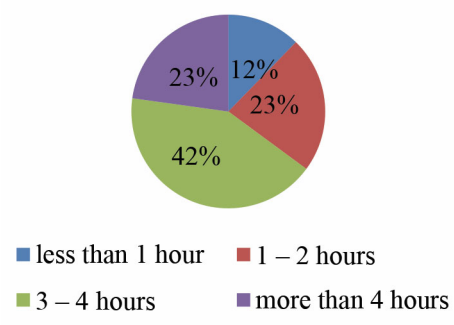

Figure 8. Daily time spent at the computer

Most students, both girls and boys (76%), rated studying as a feasible job (see Figure 9).

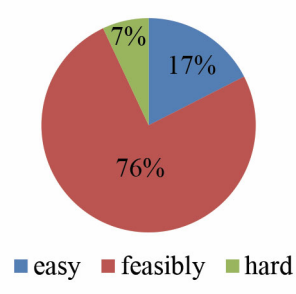

Figure 9. Students's self-assessment of overcoming studying challenges

It was difficult to study for 7% of students, and among them there were more girls than boys (9.5% vs. 5.6%). Studies seemed easy for 17% of students (every fifth girl).

Thus, students were characterised according to different criteria and the differences between different gender and age groups were revealed.

Features of processing a GDV-gram

GDV is a method of causing emissions. This means that when a short electric pulse is applied, a local and, eventually, general nerve-vascular reaction takes place, the nature of which depends on the state of the vascular, peripheral and central nervous system. Due to short time and low power of exposure, this load can be classified as micro-stress, which causes activation and training reactions. Therefore, it was discovered that from the point of view of diagnostics it is possible to use dynamic shooting modes for more information. In this work, the shooting of a combined GDV-gram without a filter of ten fingers of a person was used. In the course of the analysis of GDV-grams, various disorders of the functioning of the organs of students were revealed. Figure 10 shows the GVV-gram of a student who has a lesion in the lung and gastrointestinal tract. The figure clearly shows the disruption of the integrity of the biological field on the projections of organs.

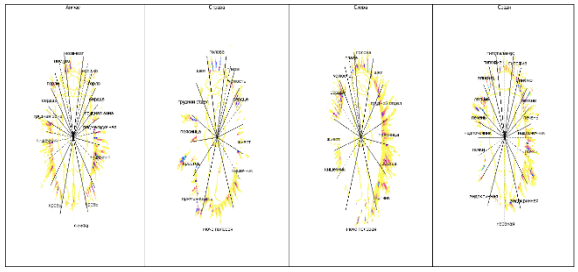

Figure 10. GVV-gram of a first year student with damadged functions of the lungs and the gastrointestinal tract

Assessment of the influence of socioecological factors on the psychophysiological state of students

57.4% of boys and 83.3% of girls aged 16 to 18 had health damage of different types (Figure 11).

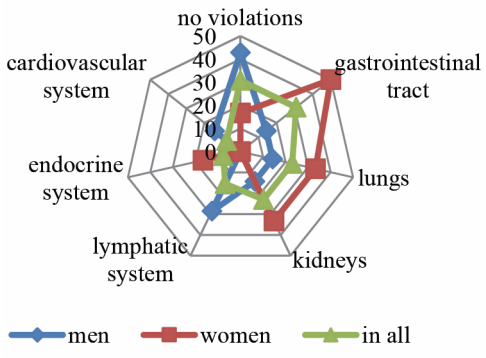

Figure 11. General health of first year students

The most common among the girls were diseases of the gastrointestinal tract, affecting 50% of the examined girls (for boys this number stood at 14.3%). Boys had disturbances of the lymphatic system (28.6%), which were not observed among girls of the same age group.

It should be noted that 16.7% of girls had disruptions of the endocrine system, which were not registered in boys. But 14.3% of the boys had a disruption of the cardiovascular system. The same proportion of boys had a liver dysfunction. 16.7% of girls had pancreatic and spinal cord disorders, which was not observed among boys. It should be noted that 46% of the students had functional impairment of several tissue systems. Consequently, unlike girls, boys had health disorders in nervous, circulatory, and lymphatic systems; girls had problems with the endocrine system. It should be noted that there were no students with the health disorders who were sleeping for 6–8 hours, 50% of them were engaged in sports, spent 3–4 hours near the computer, and they evaluated the level of difficulty of studies as voluntary. The analysis of the health status of students between the ages of 19 and 20 showed that 33.3% of students did not have a health impairment, they slept for 6–8 hours, 50% of them spent at the computer for 3–4 hours, 16.7% spent more than 5 hours, just as those spending 1–2 hours at the computer. 83.3% of the students who did not have health deviations were engaged in sports.

Figure 12 shows that the main disruptions to the health of the students were observed in the digestive system (27%), and 22% of students suffered from liver damage.

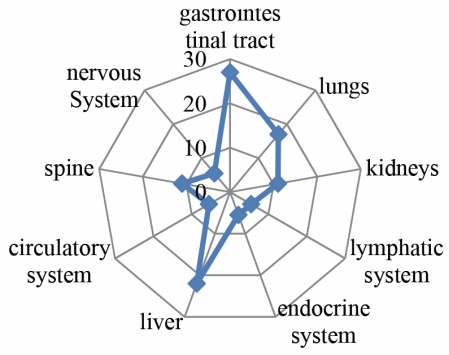

Figure 12. General state of health of third year students

Also, 17% of students had a lung disorder, and 11% had spinal disorders in different departments and had kidney problems. 5.5% of students had impaired functions of the lymphatic, endocrine and circulatory systems. It should be noted that 33.3% of students had two and 5.5% had three types of health problems. All students with a health problem had a night's sleep of 6 to 8 hours, a quarter of students spent more than 5 hours at the computer (27.8%). All of them had complex health impairment, mainly manifest in the diseases of the digestive and excretory systems, the spine and lungs. 33.3% of them were not engaged in sports. Only 11% of students rated studies as difficult, and for others they were perceived as feasible. Consequently, the main ill functioning systems of the students studied are digestive and respiratory as well as the musculoskeletal system, namely the spine. Among students aged 20 to 22, there are only 7.7% of cases of health disturbances (9.1% for boys and 6.7% for girls), which is 4 times less than for younger student groups Their night sleep lasted from 6 to 8 hours, 50% of them were involved into sports and spent 3–4 hours with the computer, the rest were not engaged in sports and spent 1–2 hours with the computer.

The analysis of basic health disorders (Figure 13) showed that 53.8% had abnormalities in the gastrointestinal tract (45.5% of boys and 60% of girls). One third of students in this age group had problems with the lungs (27.3% of boys and 40% of girls).

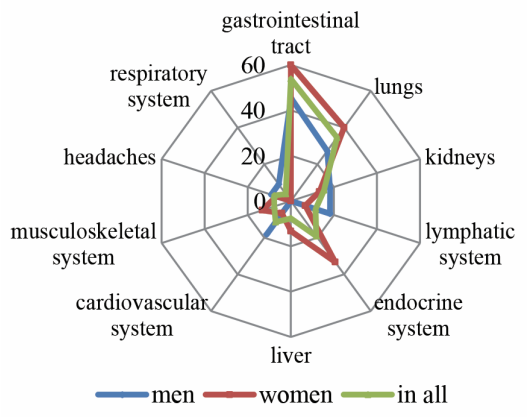

Figure 13. General state of health of fourth year students

Problems of excretory system stood at 15.4%. Boys were predominant – 18.2%, girls – 13.3%. One third of girls (33.3%) had problems in the endocrine system, and in boys such problems have not been recorded. In addition, boys did not have any abnormalities in the liver and musculoskeletal system, and in girls such disorders made up 13.3%, respectively. Also, 11.5% of students had problems in the lymphatic and cardiovascular systems; the amount of boys was three times higher than girls (18.2% against 6.7%). Consequently, in comparison with students of the younger group, there is a twofold increase in diseases of the gastrointestinal tract and lymphatic systems and almost a fourfold increase in the endocrine system. It should be noted that in this age group only 46% of students were engaged in sports, 50% spent 3–4 hours per day with computer, 11.5% – more than 5 hours, as many students spent in front of the computer less than 1 hour, and 27% – 1–2 hours. Every third student of the study group (i.e. girls) considered themselves to be meteosensitive. For 65.4% of students studies were feasible, and for 27% – easy. Harmful habits (i.e. smoking) were observed in one out of three students. 56% had disturbances of the digestive organs, 44.4% – changes in the function of lungs. Also, almost every fourth student (27%) had impairment of three or more tissue systems, which is 5 times more than that of younger students.

In general, every fifth student had no diseases, every third had impairment of two tissue systems, and every fifth – three tissue systems; more than 90% of such students in the age group of over 20 years. 40% of students had abnormalities in the functioning of the gastrointestinal tract, one third of students (31%) had abnormalities in the lungs; such changes occurred three times more often among students over the age of 20 years. Disturbances in kidney function were found in 15.8% of students (almost every fifth). Abnormalities of the endocrine system were found in 12% (mainly girls), the lymphatic system – 12.3% (mainly boys) (Figure 14).

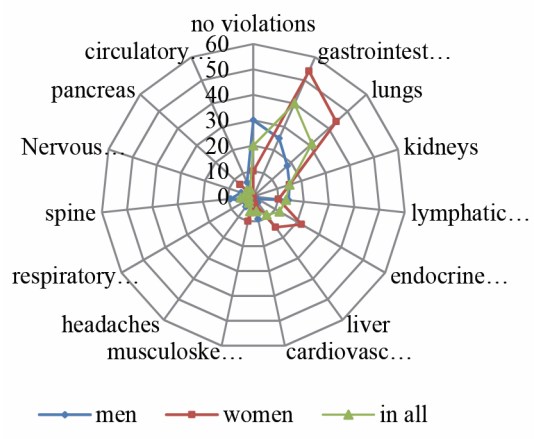

Figure 14. General condition of students' health

Also, boys tended to have diseases of the cardiovascular system (9.5%). 9% of students had disturbances of the musculoskeletal system, mainly the spine. Every tenth had a liver dysfunction. Nervous system problems were minor (2%). It should also be noted that among students aged 17 to 19, only one in ten had bad habits (smoking), rather than one in three among the older students. Among those who smoke, 61.5% had a lung disorder, and one in four had lymphatic system disorders. Analysis of all data showed that along with the age of students the incidence of diseases of the gastrointestinal tract, lungs and musculoskeletal system increased.

Influence of listening to music and smoking on the state of physiological systems of the organism

To detect the influence of music on the functional state of the human body, GVD-diagnosis was conducted before listening to their favorite music and after half an hour of listening to it. According to the data analysis of GDV-grams, it was found that at the beginning of the testing, 100% of BEO-grams of fingers were less bright and had smaller areas.

70% of students, after listening to music, had an increase in the area of the finger BEO-grams and the intensity of their glow, indicating the positive impact of music on the body as a whole, mainly on increasing the intensity of the functioning of all systems of the organism and their mobilization, which increased adaptive capacity and reduced the risk of developing pathological conditions under the influence of negative factors that inhibited the vital activity of the organism.

To analyze the effects of smoking, GDV-diagnosis was conducted directly to smoking and after smoking. The

study showed that 100% of students who had slight deviations in their health before smoking (see Figure 15), after the smoking, there were more significant changes in the state of physiological systems.

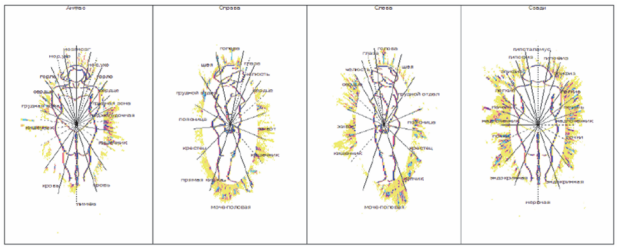

Figure 15. GDV-gram student before smoking

First of all, the respiratory system was the critical area. Also, according to the results of GVV-grams, deviations were observed in the circulatory system and endocrine systems. Such results indicate the harmful effects of smoking, which are observed under the influence of tobacco smoke on the body. After analysis of GDV-grams of students who were tested immediately after smoking, it was found that almost 100% of students had a decrease in lung function, circulatory and endocrine systems (Figure 16).

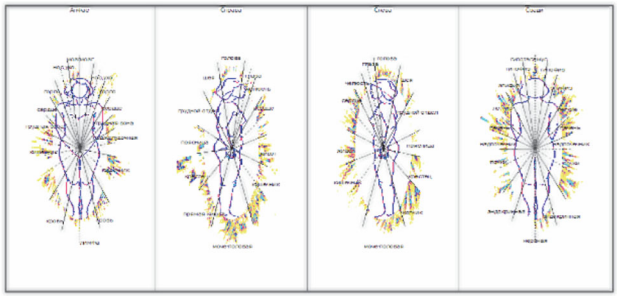

Figure 16. GDV-gram of a student after smoking

Thus, GDV-diagnostics clearly showed the immediate changes in the body's condition after exposure to factors like music and smoking.

After listening to their favorite music, 70% of students exhibited increased activity of functional systems, indicating an increase in the adaptive capacity of the body. On the other hand, after smoking a cigarette a decrease in the functioning of the respiratory, cardiovascular and the endocrine system was observed.

Conclusions

The GDV method allows diagnosing the state of individual tissues and tissue systems. After processing the obtained data, it was concluded that students had certain irregularities in their state of health; the irregularities observed can be associated with the influence of environmental factors, such as the peculiarities of nutrition, physical activity, duration of sleep and rest, intensity of mental work. Analysis of the collected data and results of GDV-screening has lead to the following conclusions:

1. Various abnormalities of the health status of students researched were detected in 57.4% of boys and 83.3% of girls aged sixteen to eighteen. The most common diseases were those of the gastrointestinal tract detected in 50% of the examined girls (14.3% of boys), lymphatic system disorders (28.6% of boys), abnormalities of the endocrine (16.7% of girls) and cardiovascular system (14.3% of boys). The same proportion of boys had a liver dysfunction. 16.7% of girls had pancreatic and spinal cord disorders, which were not observed among boys. 46% of the students studied had impairment of several tissue systems. Such abnormalities were associated with malnutrition, poor diet and smoking.

2. Analysis of the health status of students aged from 19 to 20 years showed that 33.3% of students did not have health defects; these students, just like the first-year students, had slept for 6–8 hours, 50% of them spent 3–4 hours/day at the computer, 16.7% spent more than 5 hours/day/ less than one hour/day/ 1–2 hours/day. 83.3% of the students who did not have health problems were engaged in sports. Consequently, the main health problems of the students of the study group were diseases of the digestive and respiratory systems, as well as disorders of the musculoskeletal system, mainly the spine. Such problems were associated with malnutrition, improper daily routines, as well as harmful habits, a sedentary lifestyle.

3. Among the students aged 20 to 22, there were only 7.7% cases of health disturbances (9.1% for boys and 6.7% for girls), which is 4 times less than for students of younger age groups. Their night sleep lasted from 6 to 8 hours, 50% of them exercised and spent 3–4 hours/day at the computer. Others were not involved in sports and spent 1–2 hours at the computer. The analysis of basic health disorders showed that 53.8% of students had abnormalities in the functioning of the gastrointestinal tract (45.5% of boys and 60% of girls). One third of students in this age group had problems with the lungs (27.3% of boys and 40% of girls). Such abnormalities were associated with malnutrition, poor diet and smoking.

4. The influence of music, being both a noise stimulus and a source of positive emotions, has been observed

in this study. The results show that after listening to music an increase in the area of the BEO-grams of the fingers and intensity of their glow was observed in 70% of students, indicating a positive effect on the body as a whole. Analysis of the impact of tobacco smoke – that contains a number of toxicants – has shown that 100% of smoking students exhibited a deterioration in lung function, circulatory and endocrine systems.

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STUDENTŲ EKOLOGINĖS–FIZIOLOGINĖS BŪSENOS ĮVERTINIMAS BIOELEKTROGRAFIJOS METODU

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Anotacija

Šiuo metu ypač aktualus sisteminis ekobiologinis požiūris į žmogaus kūną, kaip savaime prisitaikančią sistemą. Atsižvelgiant į daugiapakopę gyvųjų organizmų struktūrą, vienas perspektyviausių metodų – bioelektrografija (GDV), kuri biologiniuose objektuose leidžia pavaizduoti energijos srauto pasiskirstymą ir yra laikoma naujausiu metodu, siekiant suprasti gyvųjų organizmų funkcionavimą ir diagnozuoti organizmo funkcinių sistemų, kurioms daroma įvairių aplinkos veiksnių įtaka, būklę. Straipsnyje aprašomi bioelektrinių tyrimų mechanizmai ir analizuojamos bioelektrografijos metodo panaudojimo aplinkos tyrimams galimybės. Buvo panaudoti pradiniai studijuojančių studentų tyrimo duomenys, o atsižvelgus į muzikos klausymo ir rūkymo įtaką funkcinei sistemai įvertinta studentų organizmo fiziologinių sistemų būklė. Apibendrinant atkreipiamas dėmesys į GDV vizualizacijos metodo, taikant aplinkos tyrimams, ypač žmogaus ekologijai, perspektyvas, kai tiriama daugelio veiksnių daroma organizmo būklei įtaka.

Reikšminiai žodžiai: bioelektrografija, diagnostika, sveikata, aplinkos veiksniai, funkcinės sistemos.