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DYNAMICS OF EEG AMPLITUDE AND FREQUENCY CHANGES IN THE LEFT AND RIGHT PARTS OF THE BRAIN IN 17-YEAR-OLD STUDENTS WITH SANGUINE TEMPERAMENT

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The research work was devoted to the change of amplitude and frequency indicators of alpha-, beta-, delta- and theta waves in the left and right brain regions. First of all, students' temperament type and situational and personal excitement level were studied in the research. the study was conducted on 17-year-old sanguine type students in 3 stages on a regular day, before and after the exam. Our results show that the change of the amplitude of the EEG waves in both sections during the first semester exam in 17-year-old students was on a wavy line. During the examination process, the frequency-amplitude of the waves in the position of waiting for the result was strongly affected by the level of excitement. Due to the emotional tension of the exam process before and after the exam compared to the usual school day, the amplitude rhythms of alpha-, beta-, theta- and delta-waves of EEG in the right and left occipital, occipital, occipital and forehead parts of the cerebral cortex in students with sanguine temperament type a number of different directional regularities in percentage and range of spectral power are obtained.

Key words: sanguine temperament type, higher nervous activity, examination process, brain, emotional stress.

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ДИНАМІКА ЗМІН АМПЛІТУДИ ТА ЧАСТОТИ ЕЕГ ЛІВОГО ТА ПРАВОГО ВІДДІЛІВ ГОЛОВНОГО МОЗКУ У 17-РІЧНИХ СТУДЕНТІВ САНГВІНІЧНОГО ТЕМПЕРАМЕНТУ

Дослідження було присвячено зміні амплітудних і частотних показників альфа-, бета-, дельта- і тета-хвиль у лівій і правій областях головного мозку. У дослідженні, перш за все, вивчався тип темпераменту студентів, рівень ситуативно-особистісного збудження. Дослідження проводилось на 17-річних студентах сангвінічного типу в 3 етапи в звичайний день, до і після іспиту. Наші результати показують, що зміна амплітуди хвиль ЕЕГ в обох відділах під час іспиту першого семестру у студентів 17 років відбувалася хвилеподібно. У процесі обстеження частота-амплітуда хвиль в положенні очікування результату сильно залежала від рівня збудження. Через емоційну напруженість екзаменаційного процесу до і після іспиту порівняно зі звичайним навчальним днем змінюються амплітудні ритми альфа-, бета-, тета- та дельта-хвиль ЕЕГ у правій та лівій потиличній, потиличній, потиличній та лобних відділів кори головного мозку у студентів із сангвінічним типом темпераменту отримано низку різних спрямованих закономірностей у відсотковому співвідношенні та діапазоні спектральної потужності.

Ключові слова: сангвінічний тип темпераменту, вища нервова діяльність, екзаменаційний процес, мозок, емоційне напруження.

One of the stress factors is exam stress. taking the exam is quite an exciting situation. Students lose themselves under the influence of anxiety, cannot cope with anxiety, and even if they prepare well for exams, they cannot achieve good results. Therefore, exam stress is considered one of the main reasons for eliminating anxiety in students. In many cases, the exam becomes a traumatic situation for students, it has a negative effect on the mental and physiological condition of students.

Exam stress and resistance to stress depend on students' personal characteristics. During the exam session, compared to the semester period, there are changes in the psychophysiological indicators of students, which is manifested by an increase in the level of anxiety, a violation of vegetative balance, which leads to a decrease in the body's ability to adapt [8].

Electroencephalography (EEG) is considered a promising method for studying the mechanisms of cognitive functions. It is a non-invasive, safe, relatively inexpensive way to study the functional state of the brain. The characteristics of EEG rhythms recorded under different cognitive loads reflect the processes of functional modulation of the activity of cortical neural networks, which serve as the neurophysiological basis of attention, memory and other cognitive processes [7, 11].

The task of teaching staff in higher education today, based on the targets set, is to select from their methodical achievements all progressive means and thus to change, modernize, and transform the educational process, ensuring its research and exploratory character [6]. These factors affect the body of students individually and with multiple components, resulting in the change of several psychophysiological functions, especially the reactions of the central nervous system against environmental stressors [12].

Thus, such cases as violation of the regulation mechanisms in the nervous, vegetative-hormonal, mental and nervous systems and finally, changes in the dynamics of perception and memory processes, weakening and breaching of the functions of adaptation to stressful conditions are manifested [13].

Analyzing the opinions of scientists who study anxiety, we can conclude that any change in human life can cause anxiety, and the high level of adaptation processes and temperament type play an important role in preventing this. In the case of neurotic excitement, a person cannot assess the real danger. Despite numerous studies, the mechanisms of neurotic arousal have not yet been fully explored. In this regard, in the research conducted, 17-year-old sanguine students were tested under the influence of emotional stress model, psychophysiological testing methods and alpha, beta, delta, theta waves amplitude and frequency indices in the left and right regions of the frontal, occipital, occipital and occipital lobes of the brain.

The purpose of the study was to reveal the age characteristics of the changes in the bioelectrical activity of the brain, depending on the temperament type of the higher nervous activity, due to the effect of the emotional tension created in the exam process.

Materıals and methods. In the conducted studies, before starting the experiment, students' ASF temperament types were first determined by H. Eysenck test [1, 10].

Among the methods of determining the level of excitement, the recording of the electrical activity of the brain (EEG) is of special importance. During neurophysiological studies on a regular day (ND), EEG registration before the exam (BE) and after the exam (AE) was carried out in the following areas: in the right and left areas of the nape, occiput, crown and forehead. In the study, the “neuron spector 4” device was used to record EEG waves of the brain.

When conducting electroencephalography, the international installation system of electrodes is used, 8 monopolar leads; in the right and left areas of the nape, chin, crown and forehead. The reference electrode is placed on the auricle of the ipselateral ear [2].

All numerical indicators obtained during the research were statistically analyzed taking into account modern recommendations. For this, the statistical analysis of the results of the conducted experiments was carried out on the basis of statistical-mathematical methods and formulas widely used in the field of modern biology.

Statistical analysis variation and dispersion was conducted using the methods [5, 9].

The ratio of between-group variance to within-group variance allows us to estimate the influence of controllable factors on the final outcome. The statistical integrity of the influence of factors was assessed by the F-Fisher (Fisher) criterion [5, 9]. P-values of < 0.05 were considered statistically significant. All calculations were made in MS EXCEL-2016 spreadsheet and SPSS-22 (3) package program, the results were summarized in tables and diagrams.

Results of the study and their discussion. The percentage ratio and spectral power of the amplitude-frequency rhythm of all waves increased in the left and right frontal lobes of 17-year-old sanguine students compared to normal days due to the effect of exam stress before and after the exam. In the left-right frontal lobes, EEG has the same effect on the amplitude rhythm of the waves before and after the exam. The amplitude of alpha waves increases honestly ($p<0.005$). Compared to the normal day after the exam, the amplitude of the EEG delta waves in the left forehead increases honestly ($p<0.005$) – 32.5 %, the amplitude of theta waves – 11.6 %, the amplitude of alpha waves – 17.7 %, and the amplitude of beta waves increases by 12.3 %. Compared to the usual day, the amplitude of the EEG delta waves in the right forehead after the test honestly increased ($p<0.005$) by 31.7 %, theta waves by 10.7 %, alpha waves by 19.7 %, and beta waves by 16.8 %.

Therefore, the EEG of both Exam processes has both a strengthening and a slowing effect on the amplitude of the waves. It is very likely that at this age, it shows that the process of adaptation to the first exam process in students is not fully formed.

The frequency of alpha waves in the left forehead before the test was 10.0±0.4 Hs on a normal day, and honestly increased to 12.6±0.7 Hs before the test ($p<0.01$). After the exam, this amount was honestly 11.8±0.4 Hs. The frequency of beta waves in the left occiput was 17.9±1.9 Hs on a normal day, and increased to 19.4±0.8 Hs before the test. After the exam, it decreased to approximately the normal day level and was 18.3±0.8 Hs. Meanwhile, similar regularities were observed in the frequency of beta waves in the right occipital region, 16.0±1.1 Hs on a normal day, before the exam, it honestly increased to 18.6±0.5 ($p<0.01$) Hs, and after the exam, it decreased. It was 16.9±0.8 Hs. The frequency of beta waves in the right parietal region was 15.8±1.2 Hs in AG, 20.6±1.1 Hs in IE, 17.3±0.7 Hs in IS. The frequency of beta waves in the right parietal region changed according to the frequency of beta waves in the left parietal region (Fig. 1).

Before and after the exam, the frequency-amplitude of the delta-theta-alpha waves in the left-right occipital lobes increases, while the frequency-amplitude rhythm of the beta waves decreases. The change of the absolute and relative values of the amplitude of these waves is similar.

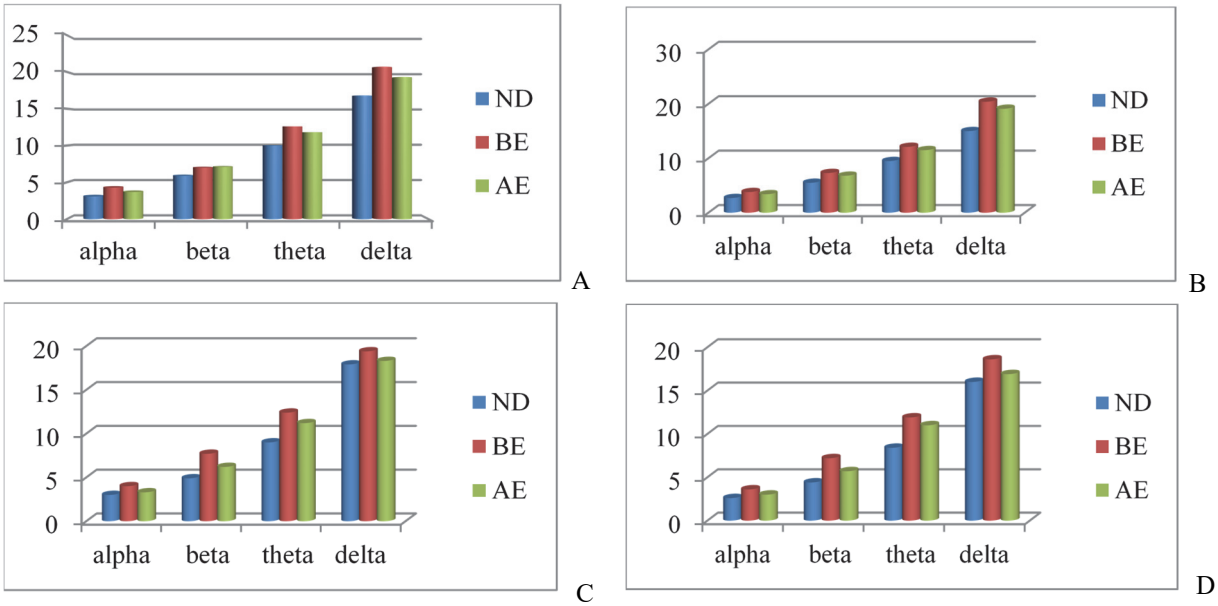

Fig. 1. Dynamics of EEG wave frequency changes (Hs) in the left and right forehead (A – left, B – right), occiput (C – left, D – right) parts of the brain in sanguine type 17-year-old students in connection with IPEG.

Thus, the changes in the right occipital lobe are more noticeable in sanguine type students. Before and after the exam, the rhythm of the frequency-amplitude of delta-theta-alpha-beta waves in the left hemisphere increased. When the EEG delta rhythm decreased before the exam in the right parietal lobe, the amplitude of theta-alpha waves increased, while the amplitude of beta waves did not change. After the examination, only the amplitude and frequency of the EEG delta waves in the right lobe of the brain decreased, while the amplitude of other waves increased.

The changes in the amplitude of the EEG waves of the left and right occipital lobes of the brain were studied. These results show that before the exam, the amplitude of EEG delta waves in the left hemisphere of the brain before the exam was 34.1 % higher, theta wave amplitude was 19.7 %, alpha wave amplitude was 23.8 %, and beta wave amplitude was 5.3 % increased (Fig. 2).

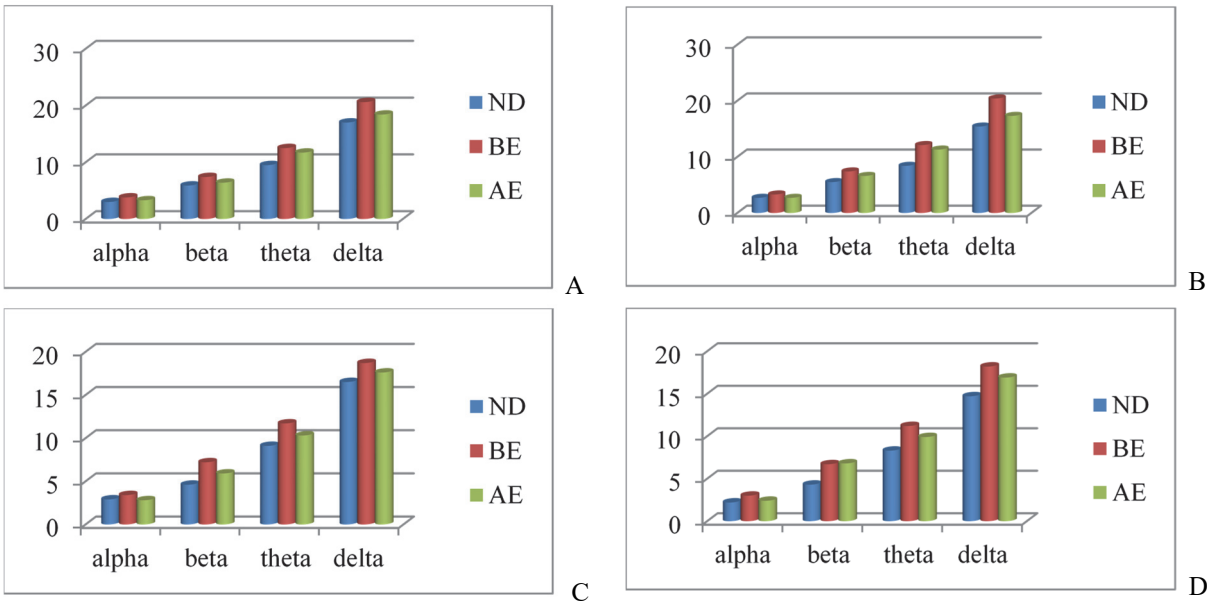

Fig. 2. Dynamics of EEG wave frequency changes (Hs) in the left and right vertex (A – left, B – right) and occiput (C – left, D – right) parts of the brain in sanguine type 17-year-old students in connection with IPEG.

After the examination, the amplitude of EEG waves in the left parietal lobe decreased slightly by 25.9 %, the amplitude of theta waves increased by 12.7 %, the amplitude of alpha waves by 15.8 %, and the amplitude of beta waves by 15.6 %. in the left parietal lobe, compared to before the exam, the amplitude of only beta waves increased by 9.7 % after the exam, while the amplitude of other waves decreased by 5.9–6.3 %. While the amplitude of alpha waves decreased by 13.7 %, the amplitude of delta waves increased by 6.6 %, theta waves by 1.1 %, and beta waves by 8.7 %. The difference during the examination process was 10.5 %.

Delta waves amplitude increased 40.8 % as honest P<0.005, theta waves 95.6 % as honest P<0.005, alpha waves 25.7 % increased 13.7 % as honest (p<0.005) compared to normal day , the amplitude of beta waves did not change. Compared to the normal day after the exam, the amplitude of EEG delta waves increased by 33.6 %, the amplitude of theta waves by 14.5 %, the amplitude of alpha waves by 29.3 %, and the amplitude of beta waves by 14.7 %.

As it can be seen, after the exam, the amplitude of EEG delta waves decreased by 5.1 %, theta waves by 4.2 %, alpha waves by 2.9 %, and beta waves by 1.1 % due to the emotional stress of the exam process in both parts of the brain, and the amplitude of beta waves increased slightly by 15.3 %.

Thus, the changes in the right occipital lobe are more noticeable in sanguine type students. Before and after the exam, the rhythm of the frequency-amplitude of delta-theta-alpha-beta waves in the left hemisphere increased. When the EEG delta rhythm decreased before the exam in the right parietal lobe, the amplitude of theta-alpha waves increased, while the amplitude of beta waves did not change. After the exam, only the amplitude and frequency of the EEG delta waves in the right lobe of the brain decreased, while the amplitude of the other waves increased.

In the studies of Berger and other scientists, the alpha and beta components of EEG recordings were clearly separated. When people feel relaxed, focused and calm, alpha waves accumulate in large quantities; in addition, beta-spleen is generated in large amounts when people are angry, agitated, and agitated [15].

Electroencephalography (EEG) is a noninvasive method for measuring electrical activity in the cortex of the brain. Because of this capacity, the EEG has become a powerful tool to predict and assess comfort levels, epilepsy, and depression [3, 14]. Additionally, previous studies have shown alterations in the frequency of EEG activity during stress [4]. In the week before examinations, medical students were found to have increases in the frequency of their beta activity when compared to their baseline EEG.

Our results show that the change of the amplitude of the EEG waves in both sections during the first-semester exam in 17-year-old students was on a wavy line. During the examination process, the frequency-amplitude of the waves in the position of waiting for the result was strongly affected by the level of excitement.

Conclusions

1. Due to the emotional tension of the exam process before and after the exam compared to the usual school day, the amplitude rhythms of alpha-, beta-, theta- and delta-waves of EEG in the right and left occipital, occipital, occipital and forehead parts of the cerebral cortex in students with sanguine temperament type a number of different directional regularities in percentage and range of spectral power are obtained.

2. However, after the examination, there is a partial decrease in the amplitude of most waves in the percentage of rhythms and in the range of spectral power.

3. Compared to the usual school day, due to the effect of the emotional tension of the exam process before and after the exam, the frequency of the alpha-, beta-, theta- and delta waves of EEG in the right and left occipital, occipital, occipital and frontal parts of the cerebral cortex in the percentage of rhythms and spectral causing a number of changes in the power range.

4. After the examination, changes in the percentage of frequency rhythms of most waves and the range of spectral power are observed.

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THE IMPACT OF ENDOCRINE PATHOLOGY ON THE OUTCOMES OF IN VITRO FERTILIZATION PROCEDURE

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The purpose of the study was to find out the influence of endocrine disorders of women on the results of in vitro fertilization procedure. We observed 191 patients undergoing treatment for infertility. Of these, 146 (76.4%) were aged 20–35 years, 45 (23.6%) were aged 36-50 years. The presence and structure of endocrine pathologies and the outcomes of in vitro fertilization were analyzed in the patients. In the structure of somatic diseases in women underwent in vitro fertilization procedure, endocrine pathology predominated: in total 14 of 20 (70 %), 12 (60 %) women had hypothyroidism, 2 (10 %) had type 2 diabetes mellitus. Almost all women with endocrine pathology (12 cases of 14–85.7 %) demonstrated unsuccessful IVF results: a higher IVF failure rate based on absence of transfer was observed in women with hypothyroidism, and based on cycle disruption–in persons with type 2 diabetes mellitus.

Key words: assisted reproductive technologies, hypothyroidism, diabetes mellitus, pregnancy.

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ВПЛИВ ЕНДОКРИННОЇ ПАТОЛОГІЇ НА РЕЗУЛЬТАТИ ПРОЦЕДУРИ ЕКСТРАКОРПОРАЛЬНОГО ЗАПЛІДЕНННЯ

Метою дослідження було встановлення впливу ендокринної патології у жінок на результати процедури екстракорпорального запліднення. Під наглядом перебувала 191 пацієнтка, яка проходила лікування щодо безпліддя. З них 146 (76,4 %) були у віці 20–35 років, 45 (23,6 %) – у віці 36–50 років. У пацієнток проаналізовано наявність та структуру ендокринної патології, а також результати екстракорпорального запліднення. У структурі соматичних захворювань у жінок, які перенесли процедуру екстракорпорального запліднення, переважала ендокринна патологія: у 14 із 20 (70 %), у 12 (60 %) жінок був гіпотиреоз, у 2 (10 %) – цукровий діабет 2 типу. Практично у всіх жінок з ендокринною патологією (12 випадків (14–85,7 %)) відзначено невдалі результати екстракорпорального запліднення: вищий відсоток невдач екстракорпорального запліднення через відсутність переносу спостерігався у жінок з гіпотиреозом, а з порушенням циклу – у осіб з цукром діабетом 2 типи.

Ключові слова: допоміжні репродуктивні технології, гіпотиреоз, цукровий діабет, вагітність.

Infertility still remains one of the problematic fields of modern medicine. Assisted reproductive technologies (ART), mainly intrauterine insemination and in vitro fertilization (IVF), have already helped many couples overcome infertility. According to statistics, millions of children have been born through ART worldwide, currently accounting for >4 % of births in several European countries. It must be remembered that the ultimate goal of ART, in particular in vitro fertilization, is the birth of a living child. As with natural conception, pregnancy failure following IVF may occur, including early miscarriage, ectopic pregnancy, intrauterine fetal death, or stillbirth. In addition to the physical and financial burden, any abortion has a destabilizing emotional impact on couples undergoing IVF cycles [2].

In this regard, the impact of any group of factors that can change the outcome of pregnancy during the process of IVF and its stages should be the subject of close study in order to minimize adverse outcomes.

Some researchers include endocrine factors in the list of such factors. With age, there is an increase in the incidence of endocrine diseases, which can have a further negative impact on fertilization rates.