Innovative methods for assessing and monitoring psychophysiological conditions of persons with intellectual disabilities

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Abstract

Objective of the study was to substantiate the use of the gas discharge visualization method in identifying the features of the psychophysiological state of people with intellectual disabilities involved in sports.

Methods and structure of the study. The method of gas discharge visualization (GDV) is based on recording the emission of electrons and photons from the skin under the action of high voltage voltage pulses. The emerging glow in the ultraviolet range of the spectrum is recorded by special cameras. When analyzing the psychophysiological state of a person, the glow is recorded from the fingers of a person. The analysis is based on the principles of Traditional Chinese Medicine (TCM), which make it possible to establish a connection between the fingers and individual organs and systems of a person.

The study took place during the year, at training events. For this study, data were selected (shooting from 10 fingers) of 200 athletes from 17 to 25 years old.

Results and conclusions. The data obtained indicate the presence of statistically significant differences in the parameters of the GDV method for the group of persons with intellectual disabilities (ID) from the group of healthy athletes. These data and their temporal dynamics can provide the doctor and coach with additional information about the current state of the observed athletes. At the same time, they cannot serve as a diagnostic sign for identifying pathological conditions.

Keywords: *psychophysiology, intellectual disabilities, monitoring.*

Introduction. Intellectual disability or dementia is a psychiatric intellectual-mnestic syndrome that can be congenital (mental retardation) or acquired (dementia). The International Classification of Diseases (ICD-10) gives the following definition of mental retardation: “Mental retardation is a state of delayed or incomplete development of the psyche, which is primarily characterized by impaired abilities that manifest themselves during maturation and provide a general level of intelligence, that is, cognitive, speech, motor and social abilities. Retardation can develop with or without any other mental or somatic disorder” [1, 2].

Sport can play an important role in the lives of people with mental retardation, as it provides a good basis for developing physical and cognitive abilities. Competition and team sports, which involve interaction between a large number of people, decision-making processes in various situations, and understanding of the game itself in its constituent parts, can be used as an effective and practical treatment for people with mental retardation [3, 4]. In order to prevent the occurrence of such adverse conditions as overtraining and mental exhaustion in people with mental retardation who are engaged in adaptive physical culture (APC) and especially sports, it is necessary to control and monitor their psychophysiological state on a regular basis. At the same time, in the process of conducting the survey, it is important to take into account the nosological and psychological characteristics of this contingent.

Table 1. *Intergroup differences in GDV parameters of experimental (EG) and control (CG) groups*

Parameter, unit measurements	Range of changes	EG, M ±σ (n=100)	CG, M ±σ (n=100)	The level of statistical significance, t-student
Stress coefficient, conventional units	от 0 до 10	3,63±0,82	3,69±1,00	0,65
Total energy, mJ	40-70 мДж	50,85±6,58	45,14±10,36	< 0,001
Balance of organs,%	-	83,21±11,09	93,64±6,85	< 0,001
Entropy coefficient, arbitrary units	от 0 до 5	1,87±0,16	2,29±0,28	< 0,001
Fractality coefficient, conventional units	от 0 до 5	2,46±0,29	3,29±0,86	< 0,001

Objective of the study was to substantiate the use of the gas discharge visualization method in identifying the features of the psychophysiological state of people with intellectual disabilities involved in sports.

Methods and structure of the study. The method of gas discharge visualization (GDV) has been developed in the mid-1990s at ITMO University in St. Petersburg under the guidance of Professor Korotkov K.G. It is based on recording the emission of electrons and photons from the skin under the action of high voltage voltage pulses. The emerging glow in the ultraviolet range of the spectrum is recorded by special cameras, converted into computer files and analyzed by original software [5]. When analyzing the psychophysiological state of a person, the glow is recorded from the fingers of a person, the analysis is based on the principles of Traditional Chinese Medicine, which allow establishing a connection between the fingers and individual organs and systems of a person. In the latest generation of GDV devices, the software is located on the server, where image processing and data analysis are carried out using a set of original programs using methods of nonlinear mathematics. Certified users use a personal login and password to access their account on the www.bio-well.com server. The examination procedure - shooting 10 fingers of one person, takes about one minute [6].

The GDV method has become widespread in Russia and in the world and is accepted by the Russian Ministry of Sports as a device for analyzing the psychophysiological state of athletes [7].

For this study, data were selected (shooting from 10 fingers) of 200 athletes. Further, a comparative analysis of the GDV-grams of these athletes, divided into two groups, was carried out. The first experimental group (EG) consisted of sportsmen with intellectual disabilities (100 people), the second control group (CG) consisted of healthy athletes of various sports and different sports qualifications (100 people).

The study took place during the year, at training events. All athletes at the time of the survey were admitted to the relevant sports activities, the distribution of parameters in each group corresponded to normal, which indicates the homogeneity of each group.

Results of the study and their discussion. The results of a comparative analysis of the GDV-grams of both groups are presented in Table 1 and Figure 1.

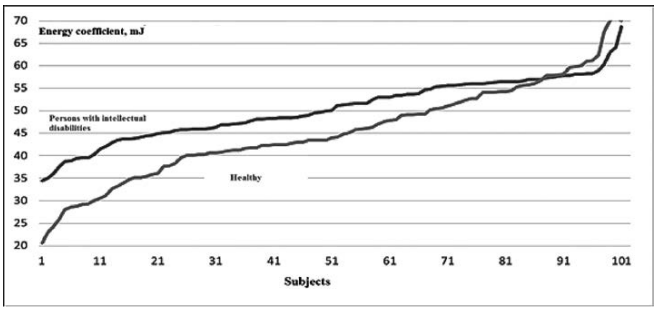

Figure 1. *Comparison of the values of the "Energy" parameter in groups of athletes with intellectual disabilities and healthy athletes*

The results of the comparative analysis show the presence of statistically significant intergroup differences at the level of p≤ 0.001 in healthy athletes and athletes with intellectual disabilities of the same age in terms of "Total energy", "Organ balance", "Entropy coefficient", "Fractality coefficient". Higher values of the parameter "Energy general" in athletes with intellectual disabilities testify not only to high energy costs, but also to an increased level of physiological activation of the body when performing motor activities. The coefficients of entropy and fractality are associated with the lability of the nervous system - people with intellectual disabilities have a certain level of inhibition of mental activity. This is also evidenced by the good repeatability of the parameters during repeated surveys at different times of the day.

Conclusions. The data obtained indicate the presence of statistically significant differences in the parameters of the gas-discharge visualization method

for a group of persons with intellectual disabilities from a group of healthy athletes. These data and their temporal dynamics can provide the doctor and coach with additional information about the current state of the observed athletes. At the same time, they cannot serve as a diagnostic sign for identifying pathological conditions.

References

1. Mikheykina O.V. Epidemiologiya umstvennoy otstalosti (obzor literatury) [Epidemiology of mental retardation (literature review)]. Obozreniye psikhiatrii i meditsinskoy psikhologii. 2012. No. 3. pp. 24-33.
2. GreydanusD., Patel D. AdolescentsandSports. NovaSciencePubInc; UK, 2010. 144 p.
3. Evseev S.P., Matveeva S.S. Opredeleniye faktorov, povyshayushchikh motivatsiyu k sistematicheskim zanyatiyam adaptivnoy fizicheskoy kulturoy [Determination of factors that increase motivation for systematic training in adaptive physical culture]. Adaptivnaya fizicheskaya kultura. 2020. No. 2 (82). pp. 20-21.
4. Zhukov O.F., Gordeev Yu.A. Zanyatiya sportom v ramkakh Spetsialnoy Olimpiady kak faktor sotsializatsii detey s umstvennoy otstalostyu [Sports in the framework of the Special Olympics as a factor in the socialization of children with mental retardation]. Moscow: Nauchnaya tsifrovaya biblioteka PORTALUS.RU. Available at: https://portalus.ru/modules/sport/rus_readme.php.
5. Korotkov K.G. Osnovy GRV bioelektrografii [Fundamentals of GDV bioelectrography]. St. Petersburg: SPbGU ITMO publ., 2001. 360 p.
6. Korotkov K.G. Sistema monitoringa psikhofiziologicheskogo sostoyaniya sportsmenov na baze oblachnykh tekhnologiy [A system for monitoring the psychophysiological state of athletes based on cloud technologies]. Teoriya i praktika fizicheskoy kultury. 2021. No. 5. pp. 3-5.
7. Korotkov K.G., Vorobyov S.A., Korotkova A.K. Psikhofiziologicheskiye osnovy analiza sportivnoy deyatel'nosti metodom gazorazryadnoy vizualizatsii (GRV) [Psychophysiological bases of the analysis of sports activity by the method of gas discharge visualization (GDV)]. Moscow: Sport, 2018. 144 p.