Study of Athletes of Various Skill Levels with GDV technology

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Introduction

Studies of athletic success have shown the importance of an optimal combination of the following factors in various sports: (1) the general psychoemotional status of an athlete, with a predominance of activity, resoluteness, and ability to work in a team (for team sports); (2) a high tone of the cardiovascular system and oxygen uptake; (3) a correspondence of the muscular structure and activity to the sports in which the athlete engages; and (4) a high level of physical training.

GDV bioelectrography is based on recording optoelectron emission of a biological object upon stimulation with short (3–5 μs) electromagnetic pulses [4]. The method makes it possible to record and quantify luminescence near the surface of the object in a high-voltage electromagnetic field (EMF). The method is used to study stimulated emission of photons, electrons, and other particles of the object exposed to an EMF or a gas discharge. Biological emission strengthens in a gas discharge and is transformed into a digital code by a video transformation system, digitalized by a computer, and imaged as a GDV-gram. The GDV-gram is a spatially distributed group of luminescence areas with different degrees of brightness. Parametric analysis of GDV-grams is based on computerized methods of image processing. Analysis of changes in GDV-grams includes calculation of the characteristics of their amplitude and geometric, brightness fractal, and stochastic parameters. These indices are measured for each finger; then their mean values are calculated (1) for all fingers and (2) separately for each hand. In healthy persons, mean fluctuations of the GDV-gram parameters within a day and within 10 min are 4.1 ± 0.8 and 6.6 ± 0.7%, respectively. A data bank formed in cooperation with specialists from the United States, Sweden, Finland, and Slovakia made it possible to identify the normal zone of these parameters in healthy men and women at different ages. GDV-gram recording is noninvasive, painless, and rapid and may be repeated many times during a therapeutic course or other procedures.

Results of Elite Athletes study

Results of the first research in sport[1] testified to essential need of theoretic, conceptual and methodical approach to planning and organization of experiments with use, on the one hand, a GDV bioelectrography method, and on the other - the special tests created for investigation of the psychophysical condition of athletes and comparable to GDV-grams presentation.

System approach claimed for development of special computer programs for the automatic analysis of all the base of the experimental data taken by means of a GDV method from five fingers of the right and left hands of examinees. The last requirement was dictated by a principle of the bilateral organization and corticovisceral regulation of psychophysiologic processes and conditions of the person that is carried out by pair work of brain hemispheres. Bilaterally taken from the right and left hands of examinees GDV-grams allow the system analysis of the results of GDV research.

In the research carried out in 2000 as examinees took part male athletes, mainly champions and participants of Olympic Games, the World and European championships, the highly skilled athletes. Study was conducted in St Petersburg schools of the Olympic reserve No. 1, 2 and the Center of the Olympic Coaching (age - 18,3±3,5 years); among participants 15 masters of sports of the international class, 26 masters of sports, 42 candidates for the master of sports. In total, more than 348 person-inspections were carried out.

According to profound medical examinations all athletes were apparently healthy, actively participated in the international competitions of Russian national teams in those sports where endurance was dominating: modern pentathlon, triathlon, skiing, skating sports, boat racing and competitive swimming.

The main outcome of these researches consisted in the proof of diagnostic value of comparative analysis of GDV-grams of elite athletes in comparison with group of simply highly skilled athletes included in control group. In experiments it was distinctly fixed that the elite athletes' GDV-grams differ by rather high degree of structuring in comparison with examinees of control group with less high level of achievements in sport (fig. 1). The characteristics for group of elite athletes (32 people):

- maximum structuring of GDV-grams;

- in 87 % cases their GDV-grams fall into types, specific for apparently healthy people.

- the combinatorics of types and base parameters of GDV-grams (the area, fractal and entropic characteristics) authentically differed ($p < 0,05$-$0,01$) from similar in control group.

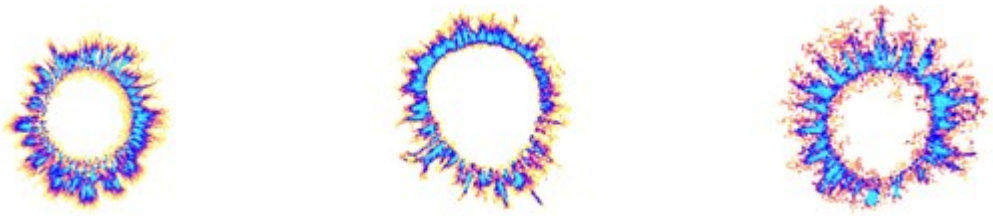


Fig.1. Typical GDV-grams of the elite athletes.

Multiple parameter (correlation and factorial) statistic analysis, carried out considering expert estimates of efficiency of competitive activity of studied athletes confirmed at 95 % significance value ($p < 0,05$) the differential and diagnostic importance of GDV-grams parameters for definition of degree of psychophysical endurance of elite and highly skilled athletes in comparison with less qualified athletes.

On fig. 2 you can see the chart of the correlation importance of the measured parameters concerning success of competitive activity for the group of athletes in sports with big physical activities. Apparently from this chart, parameters of power of an organism of the athlete, psychological factors and parameters of cardio-respiratory system play defining role in

competitive success.

Taking into consideration mentioned above and also the specifics of modern strategy of preparation of athletes we can believe that it is possible to use GDV-grams parameters reflecting both "conservative" (genetic), and "labile" signs (an actual functional condition of the athlete – his skills indicators), as markers for a long-term and short-term forecast of athletes' potential readiness to competitions. Thus, the valid conclusion was drawn that GDV-grams parameters of successful highly skilled athletes, registered in a condition of relative rest, can be the valuable diagnostic index, adequately showing level of their psychophysical potential at the moment of inspection, that can be one of criteria of their selection for national teams.

The psychophysical potential is understood as level of psycho-energy functional reserves of the organism which is genetically determined and rather steadily modified during long-term adaptation to factors of training and competitive loads in sports.

Further check of this regularity on the cohort of young highly skilled athletes showed that those who are in the so-called favorable periods of individual year differ in their GDV bioelectrography criteria by the highest level of psychoenergy indicators.

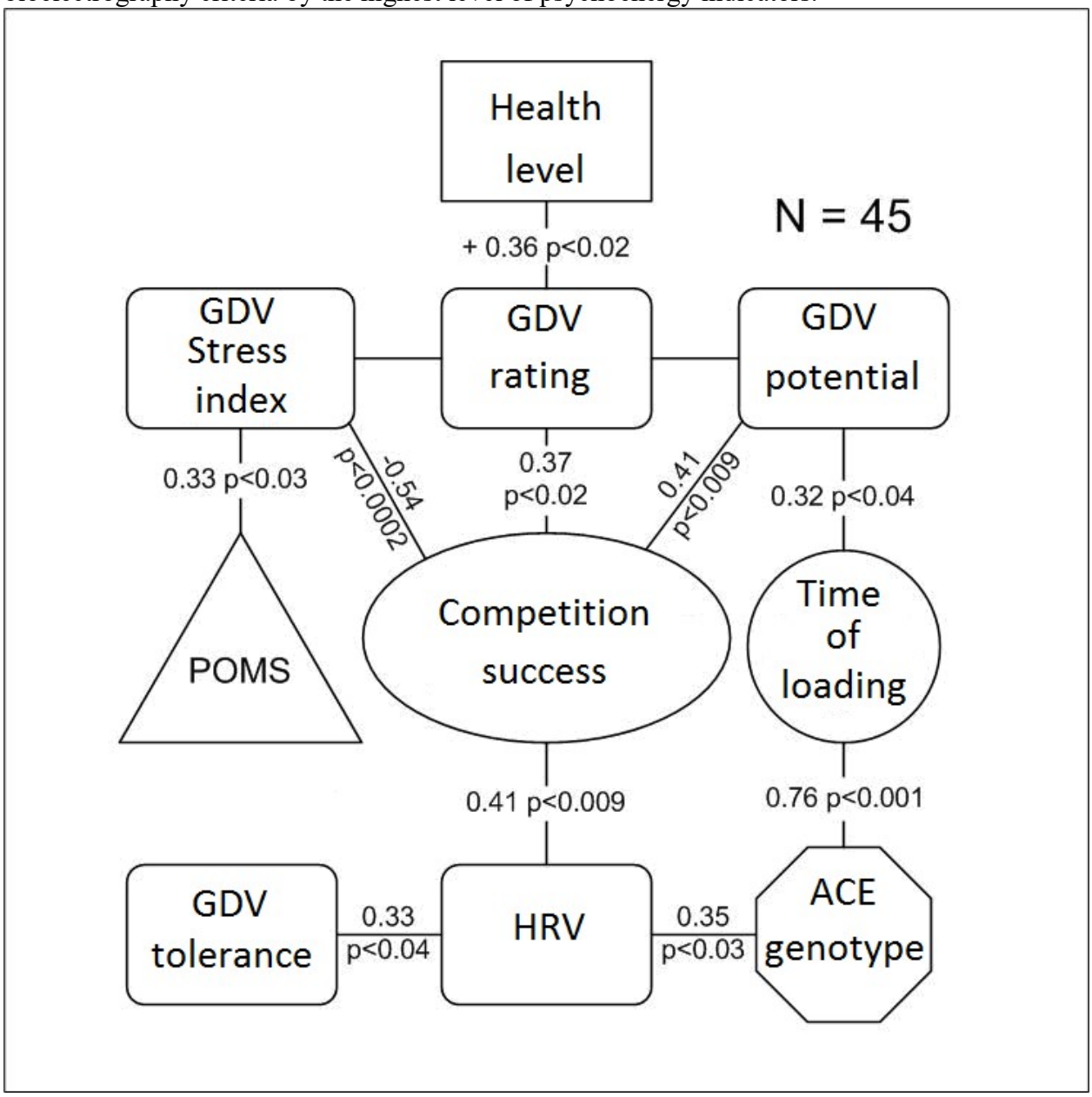


Fig.2. Correlation factors for top-level athletes. POMS – profile of mood state; HRV – heart rate variability; ACE – angiotenzin converting enzyme.

The aforesaid was rightful also because the use of the functional load in the form of imitating modeling of conditions of competitive activity («mental modeling of start») in the research testified that the highly skilled athletes, differing by high degree of psychophysical readiness according to psychological and psychophysiological inspections, have the ability to urgent ideomotor modulation of adequate to these conditions GDV-grams patterns. The revealed phenomenon was expressed in strengthening of GDV-grams fragmentation and in appearing on them in some cases the powerful distant emissions (fig.3).

The research which has been carried out in common with specialists of the Scandinavian international university (Sweden) and Kuopio University (Finland) gave the grounds to consider that a specific condition of formation of distant emission is ability of the athlete to urgent short-term immersion in a special trans condition, integration in consciousness of the athlete of all of his mental and physical conditions, called in psychophysiological literature «an altered state of consciousness» (ASC)[2].

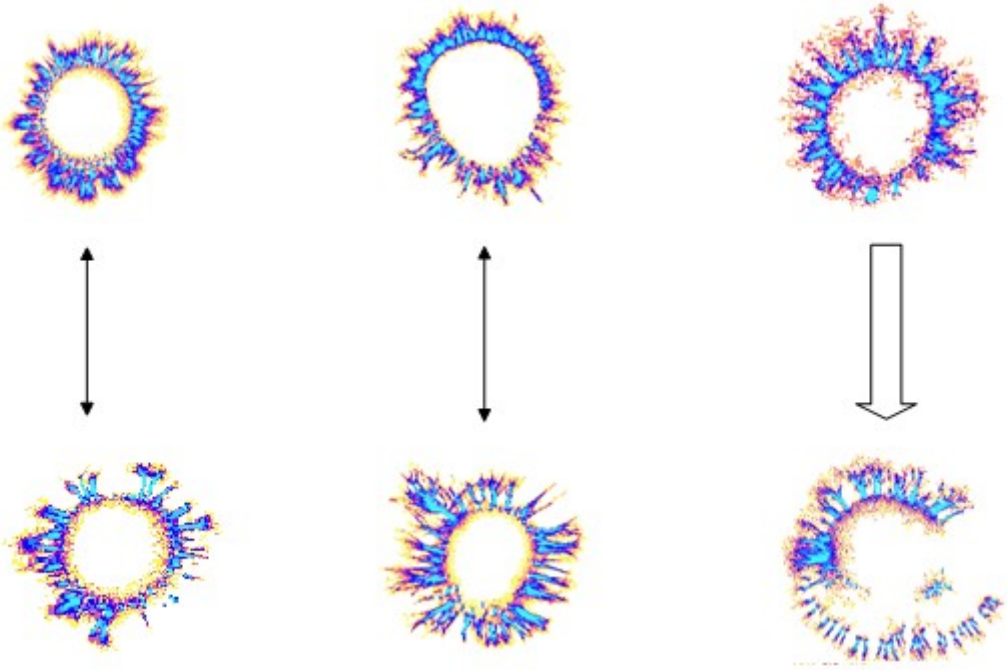


Fig.3. Transformation of GDV-grams in the process of mental modeling.

It is thus important to note that from practice of the World and the Olympic records setting it is known that "peak" of achievement in sport is connected with the ability of the athlete to short-term immersion in ASC in the moments of performance of competitive exercises[3]. For example, the well known phenomenal record of Bob Bimon in broad jumps at the XIX Olympic Games in Mexico City American sports psychologist R. Naydiffer described as: «Ideal integration in one concrete moment of all the spiritual and physical forces – the phenomenon extremely rare even for athletes of the highest class and when it nevertheless takes place, its results amaze a sporting world. An example of such integration was "space" Bob Bimon's broad jump – 8 meters and 90 centimeters at Olympic Games in Mexico City in 1968».

In many works it was shown that sharp increase of indicators of sports competitive activity and growth of skill of the athlete are connected with the improvement of processes of mental self-control of activation level of bilateral functions of a cerebral cortex. In this case we consider the formation during training activity and participation in competitions, of a mental condition which, first, is characterized by quite certain (optimum) activation level of the higher parts of brain and, secondly, is steadily reproduced by the mechanism of the truncated conditioned reflex in the conditions of realization of sports action. It is essential to note that it is

the stability of reproduction of a certain (optimum) activation level that appeared directly connected with high productivity and reliability of competitive activity. In this case it is most likely a question of reproduction of qualitatively specific condition of mental activation.

It is important to note that similar changes of activation processes are the most important neurodynamic correlate of so-called altered states of consciousness (ASC)[4].

The research carried out in actual practice of training and competitive activity confirmed that the maximum productivity of sports activity is found out in the conditions of space-temporal harmonization of activity of brain hemispheres, what is possible to trace by means of a GDV bioelectrography method.

The main conclusion was as follows: the GDV bioelectrography method allows carrying out screening of athletes of various specializations and level of training in the periods of direct preparation for competitions. This method represents the convenient modern tool for psychophysiological inspections of conditions of athletes for the purpose of a forecast of their competitive success and selection for national teams.

Individual GDV diagnostics of elite athlete

For the illustration of GDV-grams diagnostic possibilities within the international program: «The assessment and forecasting of reliability of competitive activity of highly skilled athletes» we asked to have the individual GRV inspection well-known in our country and abroad the triple Olympic Champion, the silver prize-winner of the Olympic Games in Sydney, the eightfold World champion, tenfold Europe Champion Alexander Karelin, who kindly agreed and passed through GRV-inspection mentally modeling participation in a wrestlers' fight. The results received in this experiment can be interpreted as follows:

Karelin's initial condition prior to the beginning of mental modeling of competitive activity was characterized by the powerful, accurately structured aura which has been well expressed on all fingers (organism systems). GDV-grams intensity of 2-5 fingers exceeded average statistical intensity for respectively healthy person in state of consciousness. It testified to the high power status of an organism of A.A.Karelin and activity of all functional systems (fig.4).

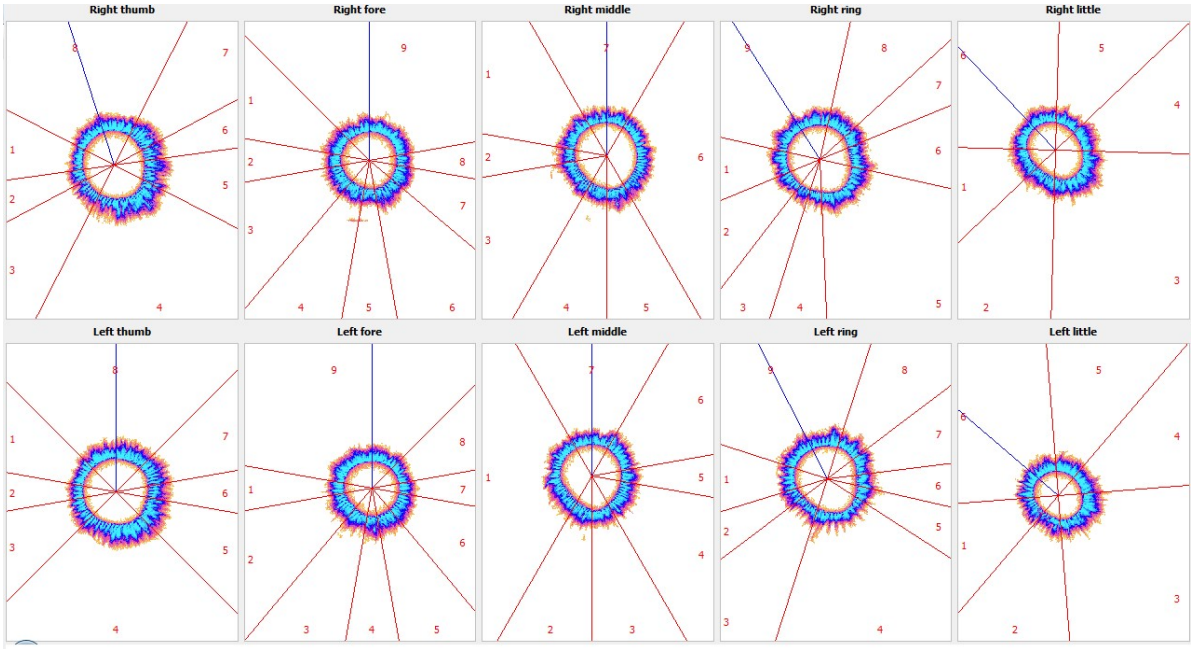


Fig.4. GDV-grams of Alexander Karelin in a calm state.

The right-left symmetry on all A.A.Karelin's fingers testified to the lack of strongly pronounced asymmetry of activity of brain hemispheres in a quiet state, that is about the balanced and steady psychological constitution. The asymmetric type of 4R with emission testified to relative suppression of processes of the left hemisphere with activity of the right one. This picture is representative for intuitive type of the personality.

Thus, given GDV-grams in Karelin's quiet state were indicative for physically healthy, active person, the extrovert, with the active attitude to the world, practical, able to influence people, with the intuitive attitude to life, being in a state of relative excitement at the moment of inspection.

In a state of mental modeling of a competitive condition sharp asymmetry of left fingers was observed with increasing activity of 1 finger. In Karelin's GDV-grams his state was characterized by blocking of activity of the right half of the body. It could be interpreted as control blocking from the left hemisphere of the brain at hyperactivity of the right hemisphere that is specific for surge of psychoenergy activation and transition to ASC - an altered state of consciousness (fig.5).

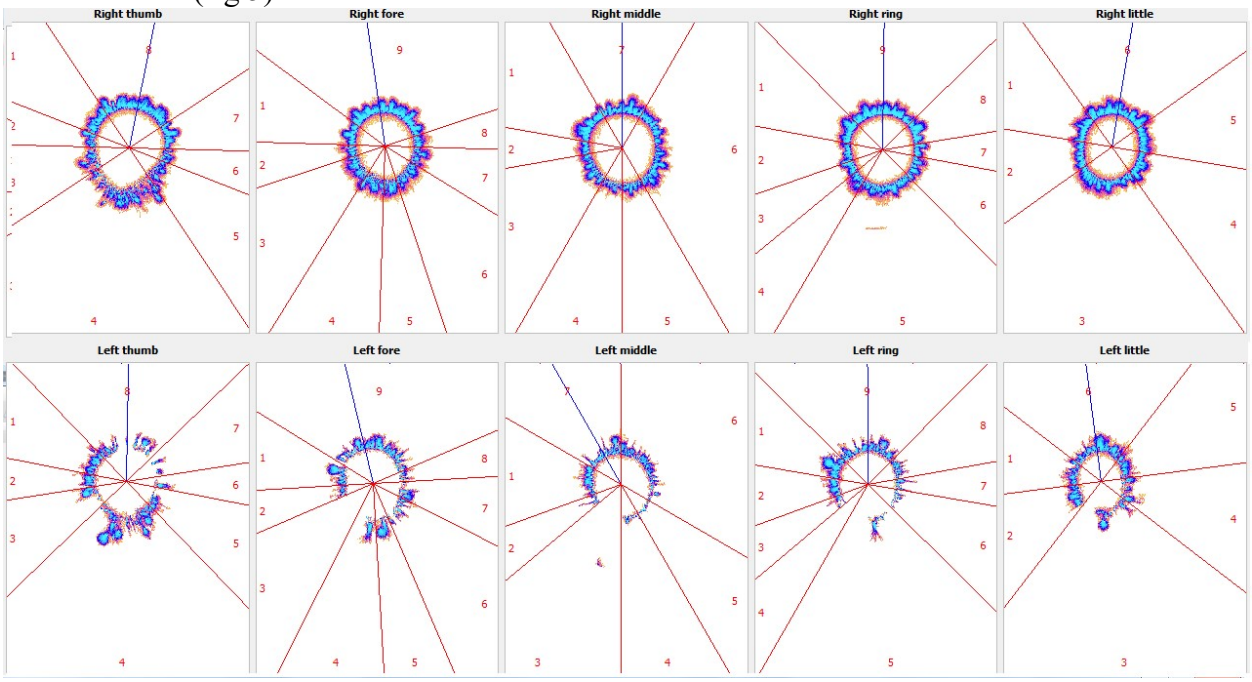


Fig.4. GDV-grams of Alexander Karelin in a state of mental modeling.

Changes in the state of the outstanding athlete observed in this experience, apparently, were indicators of transformation of his operative condition of rest into a condition «readiness for activity». Noting this phenomenon, it is expedient to speak about transition of the athlete to «the altered state of consciousness» (ASC) with the corresponding reorganization of psychophysiological and bioenergetic processes.

The analysis of the provided data on A.A.Karelin and other high-successful athletes testifies that at the expense of definition of the GDV-gram type and a stress load, it is most likely possible to obtain the differential and diagnostic data, selectively characterizing physical and mental readiness of athletes. However, this conclusion is fair only for GDV-gram of the left hand of the following fingers: 2L, 3L, 5L. The statistical data gives the grounds to consider that GDV-gram type of the specified fingers of the left hand in a condition of quiet wake and without provoking a stress factors (physical activity, a psychoemotional stress) is highly ($p < 0.001$) connected with level of the highly skilled athlete psychophysical readiness, defined by quality of endurance.

To optimum physical readiness of highly skilled athletes there corresponds generation in

a state of quiet wake the patterns of the Ia and Ib type. This state is known as «a competition condition». This fact is completely proved to be true by GDV-grams types, registered at the Russian Olympic champions. In turn, to the maximum mental readiness there corresponds generation of patterns of Ic and IIa types of emission after influence of stressful functional load.

Unlike fingers 2L, 3L, and 5L, finger patterns 4L in background activity are defined as a whole by psychophysical readiness, and only extent of their modification under the influence of physical or mental activity reflects actually mental component of readiness of the athlete.

Differential and diagnostic value of GDV-grams of various fingers of the hands, revealed in the given research, undoubtedly, needs further careful studying. However it is abundantly clear that the obtained data open essentially new possibilities in use of a method of gas-discharge visualization in diagnostics of psychophysical readiness of athletes and, in particular, creating on the basis of the GDV software of a complex of differential and diagnostic algorithm of the automated determination of psychophysical readiness.

It is thus important to emphasize that GDV-gram of high qualification athletes, who have high degree of mental readiness, is characterized by a qualitative originality in the form of high degree of structuredness and cannot be attributable to Ia-type.

Bioelectrographic correlates of psychophysiological readiness of athletes to competitions

Determination of psychophysical readiness and forecasting of reliability of competitive activity of highly skilled athletes is one of actual problems of sports psychophysiology and psychology. Considering that psychophysiological readiness of athletes for competitions is defined generally by two base factors: specific character of a mental condition of the athlete and level of psychophysiological reserves, a practical method of assessment of a condition of athletes and expert system for a forecast of success in competitive activity was developed.

Not a secret that of many athletes having the highest level of physical preparation and professional abilities, only the very few become the Olympic and world champions, and some of them hold the titles for some decades in a row. What is the difference between the elite high-class athlete and the Olympic champion? Is it possible to reveal potential readiness of the athlete for competitions?

To discussion of these questions was devoted The International scientific program, which participants were: The St. Petersburg P.F.Lesgaft State Academy of Physical Culture, the St. Petersburg Scientific Research Institute of Physical Culture and Sport, the St. Petersburg Institute of Fine Mechanics and Optics, the Scandinavian International University (Sweden), Institute of Physiology of Kuopio University (Finland), the Society "EUTROPA AG" (Germany) and the society "Kirlionics Technologies International" (Russia).

In the carried out research of the second tier besides problems of experimental approbation of GDV technologies for the purpose of identification and assessment of functional reserves and personal self-development by the integrated psychophysical training, problems of studying and an assessment of the general state of health of inspected athletes were also put ahead.

Research was carried out in the medical center of school of Olympic reserve. Athletes were inspected during planned medical examination. In total in this series of experiments before and after competitions 102 highly skilled athletes (2 masters of sports of the international class, 18 masters of sports and 82 candidates for the master of sports) were surveyed. The control group consisted of 50 students of the St. Petersburg P.F.Lesgaft Academy of Sports. Athletes of the following specializations were surveyed: swimming – 16 people, biathlon – 18 people, basketball – 22 people, a triathlon – 18 people, pentathlon – 20 people, boat racing – 8 people. A common goal – determination of endurance - allowed applying adequate for all surveyed athletes testing load on a treadmill. A common characteristic of the surveyed contingent – age: 17.8±3.7 years; height: 183.2±11.8 sm; weight 70.7±10.7 kg; Maximum Oxygen Consumption (l/min)

4.2±0.8; MOC residence time 158.5±89.9 seconds.

For the profound analysis of bioelectrographic correlates of psychophysical readiness was selected the group of 37 athletes of various qualifications who were actively performing in national teams of the city and country level. This group was subjected to the profound psychophysiological testing used in high performance sports for diagnostics of mental readiness and reliability of competitive activity.

According to the plan of experiments 23 parameters were measured to define condition of examinees, including their own value judgment of previous sports success and a forecast of their success in the forthcoming competitive activity. Therefore all examinees were preliminarily classified by experts by the level of their qualification and real sports achievements in three groups according to the degree of psychophysical readiness (DPR indicator):

1. high level of DPR (I);
2. the average level of DPR (II);
3. low level of DPR (III).

Besides, the first and the third groups were balanced by age (respectively 16.6 and 16.4 years); by sex (9 men and 1 woman); by sports (3 - swimming, 3 - basketball, 4 - skiing) and by qualification (8 Candidates for Master of Sports, 2 Master of Sports). The average rating of athletes was determined as the sum of ratings by five psychological scales, each of which was ranged from 0 to 9. For the specified groups the rating was accordingly from $X = 6.7 \pm 3.4$ to $X = 27.6 + 8.3$ ($p<0.01$).

First of all, it should be noted that comparison of a group rating assessment of readiness of athletes to their own value judgment of the psychoemotional status by the POMS technique[5] revealed statistically authentic differentiation of groups of athletes according to psychophysical readiness. This fact allows essentially simplify the procedure of verification of psychophysical readiness (PPR) in the subsequent research and to use only the POMS test with additional calculation of parameter of psychoenergy.

Essentially important result of data processing of GDV-grams of examinees is statistically authentic distinctions of parameters of GDV-grams (the luminescence area) between groups of the athletes, having rather high and low psychophysical readiness (fig. 6).

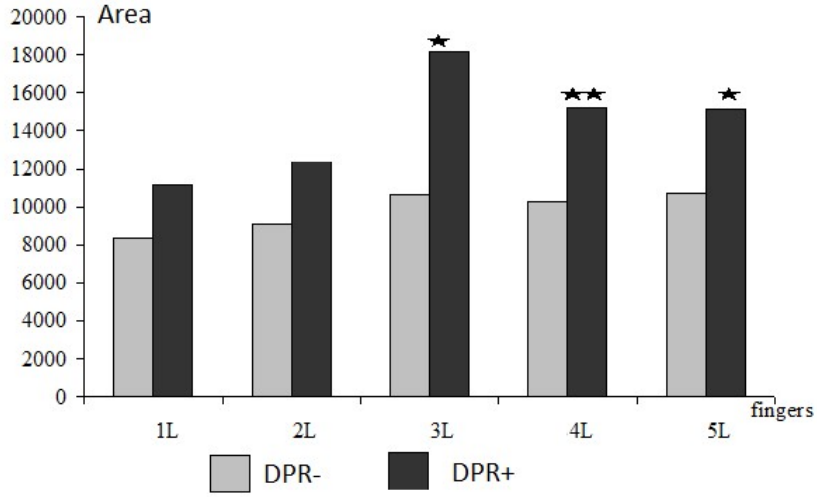


Fig.6. Area of glow for different fingers of the left hand for athletes with positive (DPR+) and negative (DPR-) prognosis of psychophysical readiness and competition efficiency.

The analysis of the type of luminescence of GDV-grams as a whole gave to experimenters the grounds to confirm that GDV-grams of the surveyed athletes at rest are relatively more structured in comparison with healthy examinees of the corresponding age from

control group. It was thus revealed that prepotent types of luminescence of GDV-grams at athletes are Ib and Ic types.

It is indicative that the groups of athletes differing by psychophysical readiness (PPR) also have essential distinctions in GDV patterns. According to experimental data the group of athletes with high DPR has essential differences from group with low DPR. It is necessary to emphasize that maximum physical activity makes the expressed impact on GDV-grams patterns, mainly in groups of athletes with rather high DPR. Statistically significant difference was revealed by comparison of GDV-grams parameters of athletes of the first and third groups.

This difference was shown for the following parameters.

- GDV-grams area of all fingers of the right and left hand;
- area of various sectors of GDV-grams of the fourth finger of both hands;
- fractal parameters of GDV-grams;
- GDV-grams types according to Korotkov's classification[6] depending on level of a destructuring or fractality increase. It was determined that at rest GDV-grams of athletes of the third group with low DPR are typical for healthy people of the same age and generally belong to Ib-type (apparently healthy). For athletes of the first group with high level of DPR GDV-grams in rest are much less structured and belong generally to Ic type with considerable percent of IIa type.

These results confirm the conclusion of our long-term research of GDV-grams of athletes of high level: prepotent GDV-gram type in rest of these athletes essentially differs from GDV-gram types of apparently healthy people and is modified after training and especially in the course of sports competitions. In aggregate with data of research carried out earlier it can be interpreted as the proof of transition of athletes of high level in a condition of the altered state of consciousness during competitions. Naturally, this hypothesis needs further confirmation. It is also important that the groups of athletes differing in DPR have an essential difference in GRV pictures.

The GDV-grams specifics of examinees in altered state of consciousness

From the previous series of experiments it became obvious that ideomotor mental modeling of elements of the competitive situation, interfaced to registration of GDV patterns, allows to reveal essential reorganizations in these conditions of energy emission processes. In this series of experiments **the phenomenon of increasing of fragmentation of GDV pattern and formation of distant emissions in process of the athlete transition to the altered state of consciousness** (fig. 7) was confirmed and analyzed. However this phenomenon was found only in athletes with high degree of mental readiness. This fact was checked by creation at examinees the mental orientation to the forthcoming competitions with the subsequent factorial analysis of the received by this way experimental GDV-data.

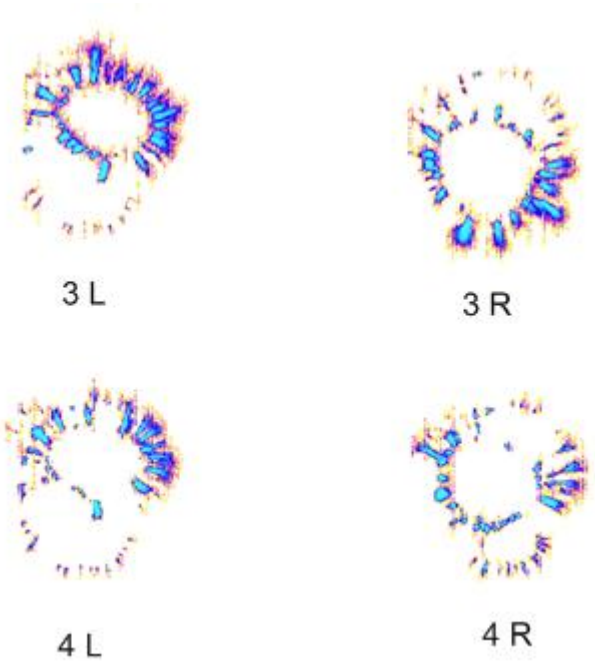


Fig.7. Example of distant emission for the athletes in the process of mental training.

For creation of mental orientation for ideomotor modeling of competitive actions, the experimenter gave to the examinee the following instruction: «Imagine that you are preparing for the start of coming competition». When the examinee plunged into a condition of concentration of internal attention to the purposes of future competition, the experimenter said to him: «And now you imagine yourself already competing». As a result of mental modeling of a competitive situation on examinees' GDV-grams the effect of change of fragmentation of a luminescence picture was noted.

For interpretation of this phenomenon the obtained data were subjected to the correlation and factorial analysis which were carried out on two independent sets of studied parameters (n=35 and n=43).

Regardless of number of parameters the factorial analysis revealed three steadily repeating tendencies in distribution of factorial scales of authentically correlated parameters ($p<0.01$).

Factor 1. The state of psychophysiological readiness.

In the first factor (at п=35, dispersion 31%) dominating value belongs to the indicator of a rating assessment of DPR($R = 0.87$). At this point statistically authentic components of the first factor are: all POMS parameters, including an index activity - anxiety; MOX; CNS features; level of concentration and kinetic potential after physical activity and GDV patterns of the right and left hands.

Factor 2. Bilateral asymmetry of parameters of bioenergetics.

In the second factor (dispersion 14 %) parameters of bilateral asymmetry on KSY-and semipermanent potential, and also GDV patterns of a number of fingers of the right and left hands ($p<0.05$) dominate. It is evident that this factor reflects asymmetry of bioenergetics.

If thus to consider that the maximum value in this factor is occupied by asymmetry of semipermanent potential which as was shown earlier[7], is connected with productivity of sports activity, connection of this factor with a condition of psychofunctional readiness of the athlete to performance of competitive load doesn't cause any doubts.

3 factor. Corticovisceral regulation of the athlete's states.

The third factor (dispersion 10 %) testifies to functional connection of the KSY-potential with a psychoemotional condition of athletes that forces to pay attention to psychodiagnostic value of the KSY-potential, possibly, from the point of view of a condition of processes of corticovisceral regulation.

Confirmation of the major role of a mental subjectively endured state of examinees as the

modulating factor, influencing features of the observable picture of GDV-gram luminescence, was the scientific achievement of this series of experiments with a GDV method. The methods of the mental training which have been invented by L.E.Unestalem (Sweden), P. V. Bundzen, K.G.Korotkov (Russia) appeared adequate means for increasing fragmentation of GDV-grams patterns at examined athletes.

Correlation analysis revealed authentic connections of mental readiness with the area of GDV-grams light-striking of 2,3,4, fingers of the right hand, POMS data (anxiety, depression, fear, fatigue, self-image - self-confidence), the area of GDV-grams in sectors of the 4th right finger - endocrine system, epiphyse and the sector 4 of the left finger - a hypophysis.

Let us specify the interpretation of the third factor concerning corticovisceral regulation of functional conditions of the athlete. It is known that the **hypophysis and epiphyse** are responsible for hormonal regulation at the very first stage of neurohumoral reaction of an organism on which all coordinated operation of internal psychophysiological mechanisms is based.

Results of the factorial analysis specify that the complex of parameters chosen for the assessment of DPR is really complementary that confirms the adequacy of use of a DPR method in sports psychodiagnostics with emphasis on GDV parameters and KSY-potential. At the same time, it is obvious that GDV-grams parameters reflect the psychophysical ready state of the athlete to work and, most likely, can be used for screening diagnostics of psychophysical potential of athletes at their selection to national teams.

It is indicative that GDV-grams of the 4th left finger find a stable relation with a mental condition and mental readiness on all contingents of athletes of high qualification. GDV-grams of the 4th left finger are as much as possible modified in the conditions of ideomotor modeling of competitive activity. One of possible explanations of this phenomenon is connection of four fingers with neuroendocrine system and, apparently, system of the power centers of the organism. Earlier maximum changes of patterns of emission of 4 fingers were found in the conditions of a self-induction of an altered state of consciousness.

GDV-research of athletes during mental modeling of competitive actions

It is essentially important that structuredness of GDV-grams patterns of athletes sharply amplifies in the conditions of mobilization of a psychoenergetic potential. Methodically the last is reached in the conditions of ideomotor modeling of the most important elements of competitive activity for the athlete and is expressed in "explosive" activation of energy emission processes and the phenomenon of distant fragmentation of GDV-grams (fig. 8). It is indicative that as shown above, similar changes of GDV-grams are found at immersion of the examinee in an altered state of consciousness at the expense of the corresponding mental practice (mental training, auto-suggestion, self-hypnosis).

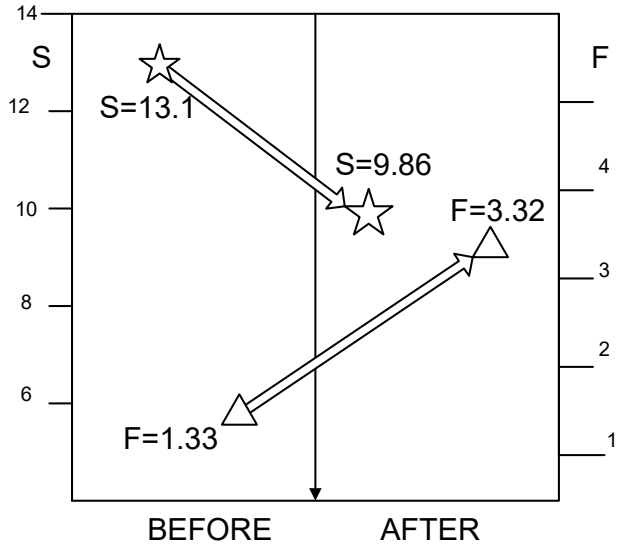


Fig. 8. Influence on GDV-gram parameters of examinees the intellectual modeling of a situation of competitive fight by the method of ideomotor training. S–luminescence area; F– quantity of fragments; Before – before modeling; After – after modeling;

The same patterns come to light at research of actors in the conditions of carrying out special training and at a number of professional healers at the moment of mental modeling of healing activity.

In this regard there are bases to assume that one of important components of mental readiness which is obviously possible for diagnosing at the expense of a GDV method is *an ability of the athlete to a self-induction of an altered state of consciousness* at the moment of realization of sports skill. Apparently, easy transition of the athlete to such condition (ASC) is possible only if the athlete is well trained, psychologically ready to start, i.e. is in so-called «competition form».

The last has the basic value since the top of sports success (peak "performance") is reached in the Olympic sports in the conditions of an altered state of consciousness of athletes in a "competition form". Thus, the GDV bioelectrography method with use of computer analysis of GDV-grams introduces essentially new possibilities in technology of forecasting of psychophysical readiness of athletes to competitions in the Olympic sports.

The revealed bioelectrographic correlates and differential and diagnostic characteristics of psychophysical readiness of the qualified athletes made it possible to approach the solution of the main issue - *to the analysis of connection of patterns of energy emission processes with productivity and reliability of performance of athletes in important competitions.*

For this purpose in the Center of the Olympic training of St. Petersburg expert estimates of productivity of 17 participating masters of sports in swimming, a triathlon and pentathlon for the current year were received. On the basis of these data the rating of analyzed group of athletes was constructed:

5–the winner of the international championships and competitions;

4–the winner of the Russian championships;

3– the winner of the Russian individual championships;

2– the winner of the Cup of Russia;

1– the winner of the regional championships and individual championships.

Selection of athletes for performances in domestic competitions was carried out by trainers and teachers taking into account level and stability of results in a year cycle of training and competitions. Thus, in a certain measure it is possible to say that criteria of selection included productivity as well as actual reliability of sports activity. As it is seen from the results

of the analysis, the indicator of physical readiness finds direct link with indicators of integrated power, tested in a condition of relative rest (before functional loads) and accordingly to GDV-grams areas in these conditions. These data correspond to the results received by differential and diagnostic attributes of GDV-grams types.

Unlike this, productivity of competitive activity finds direct link ($P<0.01$) with indicators of integrated power after psychophysical functional load (the test for deduction of the maximum working capacity). Here the connection of an indicator of productivity with GDV-grams areas after functional load comes to light.

The obtained data allow coming to a conclusion that GDV-grams area and indicators of integrated power of the right and left hands, and also extent of their change under the influence of functional load, apparently, can be one of *prognostic* characteristic of reliability of performances of the athlete in sports on endurance.

Considering features (psychophysical character) of received functional load, there are bases to believe that reorganizations of GDV patterns under its influence reflect the potential of psychophysical mobilization of the athlete. It is natural that the expressed assumptions demand further focused workup and verification.

The received results allow to argue that patterns of gas discharge visualization of power emission processes reflect a psychophysiological condition of the person and *can be used for the solution of problems of functional diagnostics and, in particular, psychodiagnostics and definition of extent of mental preparation of athletes in sports of the highest achievements.*

Genetic and psychophysical determination of bioenergetic of organism

A set of methods were utilized for this study allowing to create a characteristic profile of the sportsmen's organism psychophysical condition and genetic status:

1. Neuro-psychic status, typology (extraversion - introversion), neurotization level, psy-choenergy potential and psychical activity evaluated with POMS test.
2. Functional state with maximum oxygen consumption test and tests using critical load holding .
3. Quantum-field level of organism bioenergetics based on measurements of GDV bio-electrography evoked emission processes with computerized complex “GDV-camera”. Aver-age basic parameters of the fingers glow patterns (GDV-grams): area, density, spectrum, en-tropy, and fractality were calculated; parameters were calculated both for every finger and averaged by ten fingers of the left and the right hands.
4. Genotype characteristics of the athletes, i.e. those attributed to II, ID and DD variants of the angiotensin-converting enzyme (ACE), shown to be correlated with an organism's en-ergy balance . In this analysis, genome DNA was extracted with alkali from the cells of oral mucous membrane, with the polymorph part of the gene amplificated by polymerize chain reaction, and these reaction products determined via electrophoresis in 8% polyacrilamid gel.
5. Physical endurance test exercises, measures of speed-strength qualities and explosion force. Treadmill by “Quinton” (USA) was used in the following regimes: the athlete speeded 6 km/h at the first step, 9 km/h at the 2nd step and 12 km/h at the 3rd step. Inclination angle was 5% and duration of every step three minutes. Then inclination angle was increased to 10.5% with duration one minute. At the last step the angle was 12.5%, speed 12 km/h and ath-lete was motivated to run as long as possible.

During this test heart rate was continuously registered with “Polar Electronic” tester and every third minute outward breath was analyzed with “Bekkman” gas-analyzer.

6. Expert evaluations of athletes readiness in the frames of track-and-field specialization (800 and 1500 m middle-distance race, 50 m sprint, hurdle race, hop, shotput, grenade throw-ing, high jump and broad jump);
7. Rating of competitive effectiveness of participation in international and Russian cham-pionships.

The research was performed at the Olympic Training Center of St. Petersburg during 1999-2001 in several independent sessions. Groups of athletes demonstrating various levels of skills and specialization were tested, including members of the Russian Olympic team. Statistical analysis was done for several groups: 83 athletes, 27 athletes, 40 athletes (average age 17.8+3.7 years) and 29 students of Lesgaft State Academy of Physical Training, specializing in track-and-field athletics (average age 16.9+0.8 years). For this particular group of track-and-field students measurements were performed three times during a year cycle of training activity (August, November and May).

The results of investigation were processed, using methods of multi-parametric analysis by means of statistics software package "STATGRAPH-5" using Fisher and Student criteria. Reliability of test was accepted with $p < 0.05$.

Experimental results and discussion

Comparison of the data obtained with athletes' performance results demonstrated that for athletes having high psychophysical potential GDV-grams have distinctive features that may be described with a set of quantitative parameters. Distribution on GDV-grams types was as follows: Ib type – 32%, Ic type – 37%, IIb type – 19% and IIa type – 12%. Mean values of integral GDV parameters for the entire group were as follows:

JSL= - 0.548+0.312 and JSR= - 0.612+0.343

Multiparametric correlation and factor analysis for a big set of the above mentioned parameters reveal highly reliable statistical correlations between physical, psychological and quantum parameters of athlete's functioning.

Fig.9 demonstrates results of statistical analysis of experimental data as a correlation graph. It is obvious that functional parameters characteristic of the athlete physical state (MOC, physical loading holding time, oxygen pulse, etc) reveal direct differential correlation with the GDV bioelectrography parameters. In particular, parameters, dependent on cardio-respiration endurance, reveal correlation with JSL of the left hand ($p < 0.05$). Detailed analy-sis demonstrated the most stable correlation indexes with the GDV parameters of the left hand fourth finger. Parameters characteristic of the psychic endurance (psychoenergetic coefficient, "vigor" parameter) correlated with dispersion DJS of left and right hands.

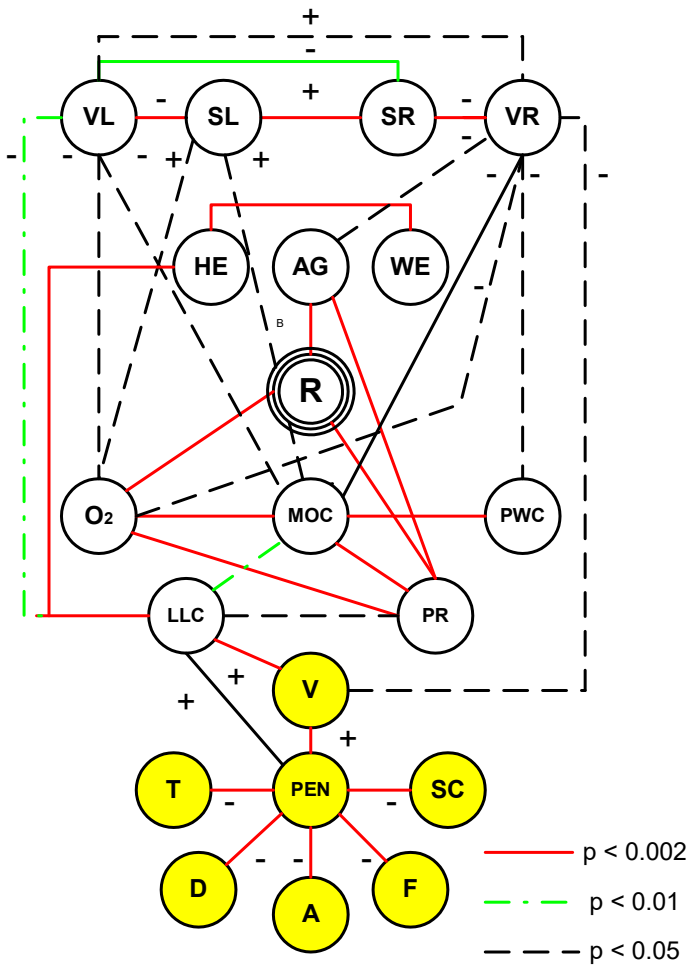


Fig.9.Correlation graph, characterizing connection between the integrated GDV-parameters (VL, SL, SR, VR) and verified parameters of functional test of highly skilled athletes' psychophysical potential. R – competition activity successfulness, HE – height, WE – weight, AD - age, O2 – oxygen impulse, MOC – maximum oxygen consumption, PWC – period of maximum physical load retention, LLC – life lungs' capacity, PR – pulse rate, V,T,D,A,F,SC – parameters of psycho-emotional condition ac-cording to POMS test, PEN – psycho-energy coefficient

Of particular note is the very strong correlation ($p<0.001$) of the GDV parameters with the maximal oxygen consumption index (MOC) used in psycho-genetics as an endurance marker having genetic determination 10. These are a direct correlation for parameters (0.37 for JSL and 0.36 for JSR) and inverse correlation for their dispersions (–0.38 and –0.42 respectively). As emphasized by the foregoing authors, the essential components are, first of all, high level of heritability of this factor (0.66-0.93) and, secondly, limitation of MOC growth frames in the course of the training process by individual genotype.

At the same time the correlation graph demonstrates selective correlation of GDV parame-ters (DJS) with POMS parameter of psychic power ($r = -0.42$) and with the time of holding of critical loading ($r = -0.37$), i.e. endurance.

Functional loads (treadban training and ideomotor modeling of competition performance elements) exerted a pronounced influence both on GDV-gram types and on GDV integral indexes. After the load the GDV parameters of the right hand had higher weight factors as they are correlated with physical activity. After the load the correlation with the coefficient of psy-cho-energy by "POMS" test increased. This data statistically confirmed a concept of impor-tance of psychological factor in effectiveness of purposeful physical activity. It was previ-ously demonstrated that the high coefficient of psycho-energy corresponds to "iceberg-type" of

"POMS" test with peak value of quality "vigor" and suppression of qualities "anxiety" and "uncertainty". Based on the data obtained, it is possible to conclude that the GDV method gives a practical way to objective instrumental measurement of these qualities.

To further explore these revealed regularities a longitudinal complex study of track-and-field athletes during the course of a yearly cycle of training activities relative to their ACE genotype differentiation by methods of molecular-genetic analyses was undertaken[8].

At the outset, it became clear that as a result of multiple independent measurements of this large group of athletes, a credible correlation of effectiveness for physical exercise performance related to endurance quality with their individual ACE genotype and GDV parameters was statistically demonstrated ($p<0.01$). This dependence was revealed for the majority of GDV-gram basic parameters, in particular, for integral parameters JS (fig.10). Distribution of athletes according to their sport results corresponded to the type of genotype in compliance with the series II-ID-DD.

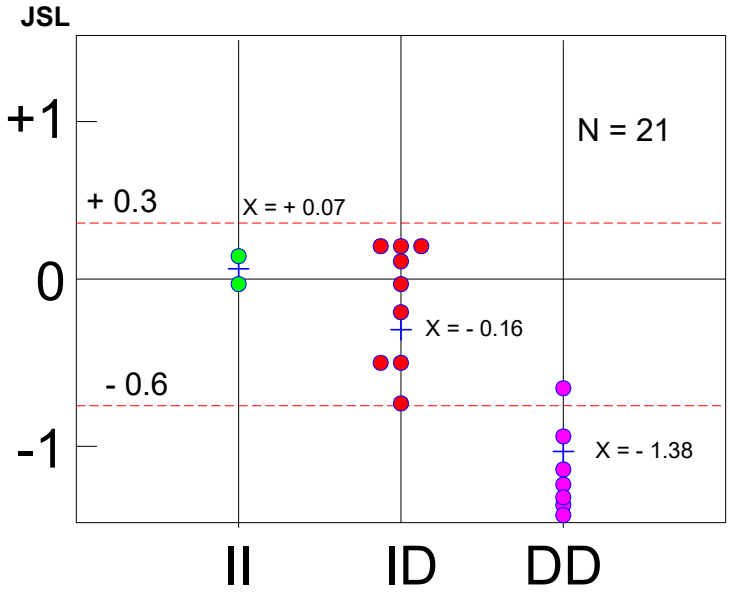
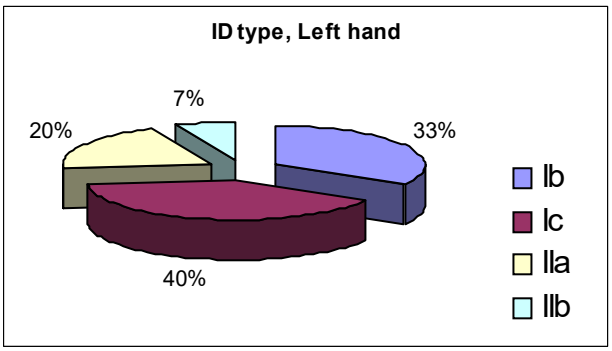


Fig. 10. Dependence of integral values of evoked emission processes (of GDV-grams) on the angiotensin-converting enzyme genotype of 21 students, specializing in track and field athletics.

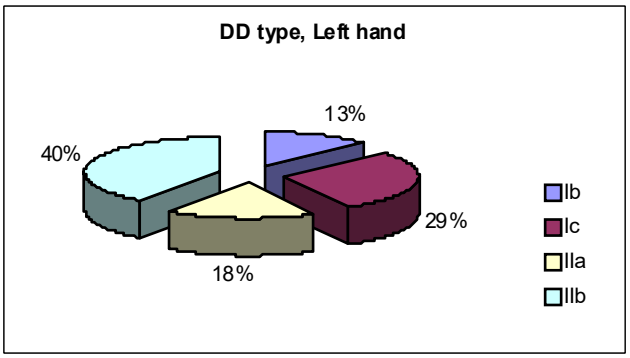
Therefore, the results of analysis of GDV-gram parameters give a reason to speculate that genotype features of a person, defining endurance quality, reveal a connection with specifics of functional organization of quantum-field level of an organism's bioenergetics.

This conclusion is confirmed by the results of computer analysis of GDV-grams of a group of athletes using "Data Mining" methods with the purpose of automatic differentiation of one more GDV-parameter: GDV-gram types in accordance with classification by Dr. K. Korotkov. Analysis is based on the Bayes' classification system. 180 GDV-grams passed ex-pert evaluation – two groups of 90 sportsmen with ID and DD genotypes.

The analysis' results, shown in figure 11, demonstrate that for the ID genotype athletes' group Ib and Ic GDV-gram types dominate, while for the DD genotype group IIb and Ic types prevail. The differences mentioned are most distinctly revealed on the left hand fingers' GDV-grams: 3L, 4L and 5L. It is worth mentioning that the specificity of functional organiza-tion of the right and left hands fingers' GDV-grams was also discovered within the investiga-tion of relation between the bioenergetics quantum-field level and the psychophysical readi-ness of skilled athletes, training their endurance.



A.



B.

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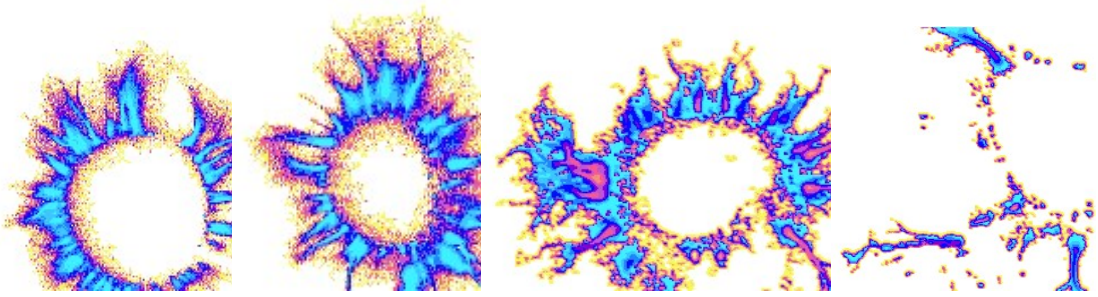

I b I c II a II b

Fig. 11. Average statistic distribution of GDV-gram types of athletes having angiotensin-converting en-zyme ID (A) and DD (B) genotypes (for every chart 45 images' averaging was carried out) and exam-ples of the corresponding GDV-grams of different types (C).

According to the results of statistical analysis, genetic conditionality of GDV-parameters has relatively stable character and is revealed within a year training cycle, in spite of reliable changes of bioenergetic status of the investigated athletes' groups. (fig. 12). The curves given show that all student athletes from the group in fig. 2 demonstrated improvement of integrated GDV-parameters, however the absolute values in the II-ID genotype group were much higher.

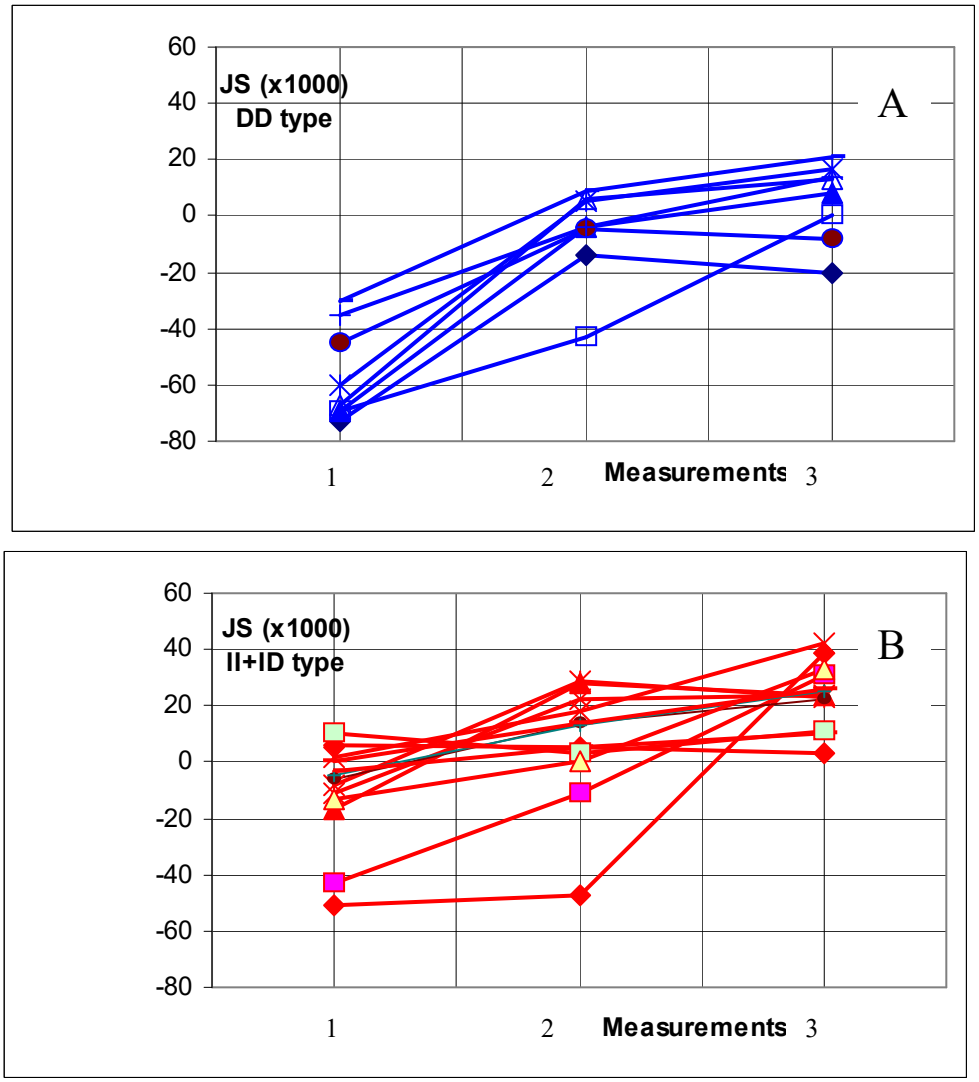

Fig.12. Time variation of integrated GDV-parameter for the group of 19 athletes with differ-ent angiotensin-converting enzime genotype. A – DD type; B – ID + II types; Time of meas-urements: 1 – August 1999; 2- November 1999; 3 – May 2000.

In that way, organization of bioenergetic processes on the quantum-field level is appar-ently quasi-stochastic in its character and along with genetic determination (relatively "strict factor") depends on the changes of the objects' psychophysical potential during short- and long-term adaptation to the environmental factors.

Results of the multi-parametric data factor analysis, as compared to sport effectiveness, in three separate measurements during the year demonstrated the presence of reliable functional correspondences between the ACE-genotype, integrated GDV-parameters and middle-distance (800-1500 m) race results - i.e. sport potency was connected with endurance quality. In this case maximum effectiveness was characteristic of II and ID genotype athletes and minimum - of DD genotype ones ($p<0.05$).

Thus, the above given research provide compelling reasons to assume that the quantum-field level of bioenergetics of the human organism, as well as substrate level composed of the biochemically aerobic and anaerobic processes of maintenance of muscle activity, is subject to genetic determination.

As indicated by the results of statistical analysis, this regularity is revealed within the whole period of research, i.e. a year cycle of training activity, which is the confirmation of relative stability of the genotype influence. However, this data discloses a very relative stabil-ity, albeit statistically reliable, which suggests that the degree of influence of the genetic fac-tor

(ACE subtype) on the parameters of bioenergetic of quantum-field level progressively de-creases within a year cycle of training, as shown by the correlation and factor analysis data. Thus, factor values of parameters of GDV-grams JSL and JSR in a year cycle decrease from 0.83 and 0.76 respectively to 0.49 and 0.55. From the functional viewpoint, these changes can be interpreted as the influence of the so-called “medium” factor on the effectiveness of sport activity. In our case this factor is the training process, forming functional psycho-physical re-serves of sportsmen during long-term adaptation to physical loads.

The last statement was tested independently on two groups: 27 and 40 sportsmen. GDV-grams of all fingers were measured and GDV-parameters were calculated. Figure 13 demon-strates experimental data presented in complex GDV-parameters’ coordinates for the first group. This assessment enabled the determination of three groups of athletes having expressed differences in their adaptation to long-term physical loads. Comparison with other data re-vealed that the groups reliably differed in genotype characteristics, psychophysical potential and sport activity effectiveness. In particular, R axis at fig.13 represents athletes’ competition rating during the year. It is worth mentioning clear correlation of the difference of left and right hands activity (JSL – JSR) with sport activity effectiveness. This may be interpreted as a higher interrelation of the brain hemispheres for more effective sportsmen.

Useful results might be received presenting experimental data in multiparametric space. The results of cluster analysis of 40 athletes' data in three-dimensional space of GDV-gram parameters: entropy, normalized area, and fractality, are given in fig. 14. As demonstrated in the figure, there is a well-defined distribution of data by GDV-parameters into 3 groups. Again, according to the analysis, each group consists of sportsmen distinguished by psycho-physical characteristics, effectiveness and, to a certain extent, by genotype.

In conclusion it is worth emphasizing that the dependencies between the genotype charac-teristics of an individual according to ACE, parameters of induced energo-emission processes, as well as the growth of psycho-physical potential of athletes in the course of training activity found in the present research are quite explicable, if we take into account specific character of ACE genotypes. These genotypes determine functional resources of both cardio-respiratory system of the organism and central nervous system .

It should be mentioned that all experiments were carried out under double blind test mode: experimental groups, which were involved in collecting data, computer processing, and ana-lyzing athletes’ efficacy, were not connected with each other, and they were working in dif-ferent institutions. What is more, the possibility to measure athletes' genotype status appeared after carrying out two cycles of GDV-parameters' measurement and their full processing.

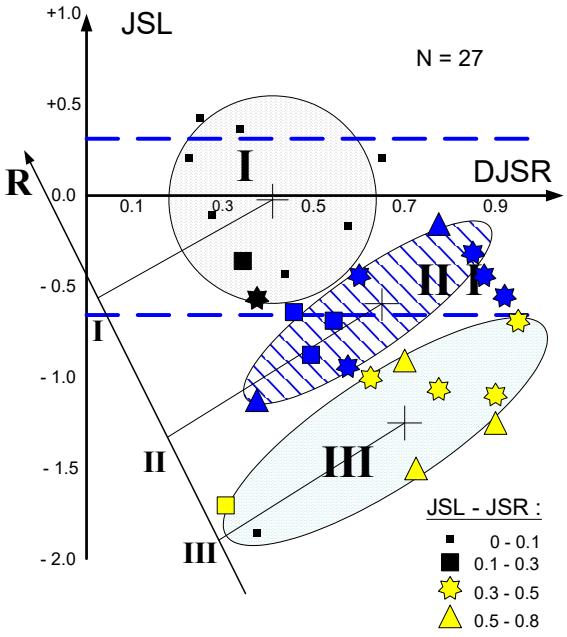

Fig.13. Highly skilled athletes' differentiation (N=27) on the basis of integrated GDV-parameters (JSL, DJSR) into groups (I, II, III) distinguishing by psychophysical potential and the sport activity effec-tiveness (R – axis of the competition activity relative successfulness).

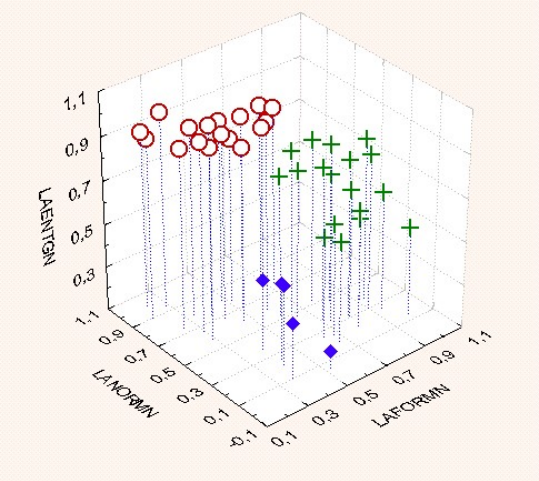

Fig. 14. Cluster analysis of 40 students' data taken from the 4th left hand finger in the three-dimensional space of BEO-gram parameters: entropy, normalized area, and fractality.

Examples of complex research in sport

The following methods were used in the study of young athletes:

1. Anthropometrical analysis and diagnostics of the morphofunctional status (height, weight, arterial pressure, pulse in rest and under load).

2. Determination of health quality.

3. Molecular and genetic methods, DNA analysis. Genetic predisposition was defined on the basis of identification of II, ID and the DD alleles of angiotensin converting enzyme (ACE) correlating with productivity of competitive activity for elite athletes in sports, demanding physical endurance. DNA genome was extracted from saliva, the polymorphic part of a gene reinforced in polymeric chain reaction, and products of reaction were defined with the electrophoresis in 8 % polyamide gel

4. Analysis of an energy homeostasis, GDV-diagnostics.

5. Diagnostics of the psychoemotional status and sports important features. The psychoemotional status was determined with the help of the Russian version of the POMS test by a way of determination of quantitative values of six indicators: uneasiness (T), depression (D), aggression (A), activity (V), fatigue (F) and confusion (C).

6. Diagnostics of a psychomotor system and psychomotor mobilization.

7. Registration and determination of variability of a cardiac rhythm (VCR) was carried out by means of "Polar Electro OY" and "Heart-Tuner" cardiac monitor in a supine position in the condition of relative physiological rest. Mathematical processing of the received results was made in the Polar Precision Performens software. Parameters of a time domain, parameters of scattergrams and histograms were calculated. For creation of histograms the interval of 0.05s was used. In addition, absolute and relative values of capacity of a range of periodic fluctuations of a cardiac rhythm in standard frequency ranges were defined: ≤0.04Hz (VLF), 0.04-0.1 Hz (LF), and 0.1-0.4 Hz (HF), and also amplitude of a range on all frequencies with a period of 0.01 Hz.

6. Correlation and factorial analysis in "Statistica" program were used, and methods of artificial intelligence were applied to creation of models of activity on the basis of the revealed

regularities.

Participants were 37 young men age 15.97±0.83 and 196 young women age 16.15±0.92 years, 17 masters of sport, 138 candidates of master of sport and 51 junior level practicing in active types of sport.

Multiple parameter (correlation and factorial) statistical analysis which has been carried out taking into account expert estimates of efficiency of competitive activity, confirmed the differential and diagnostic importance of the revealed parameters for determination of psychophysical endurance of athletes. The chart of fig. 15 of the correlation importance of the measured parameters concerning success of competitive activity for group of athletes in sports with big physical activities for two years is provided. As we can see from this graph, parameters of the athlete's organism energy, psychological factors and parameters of cardiorespiratory system play defining role in competitive success.

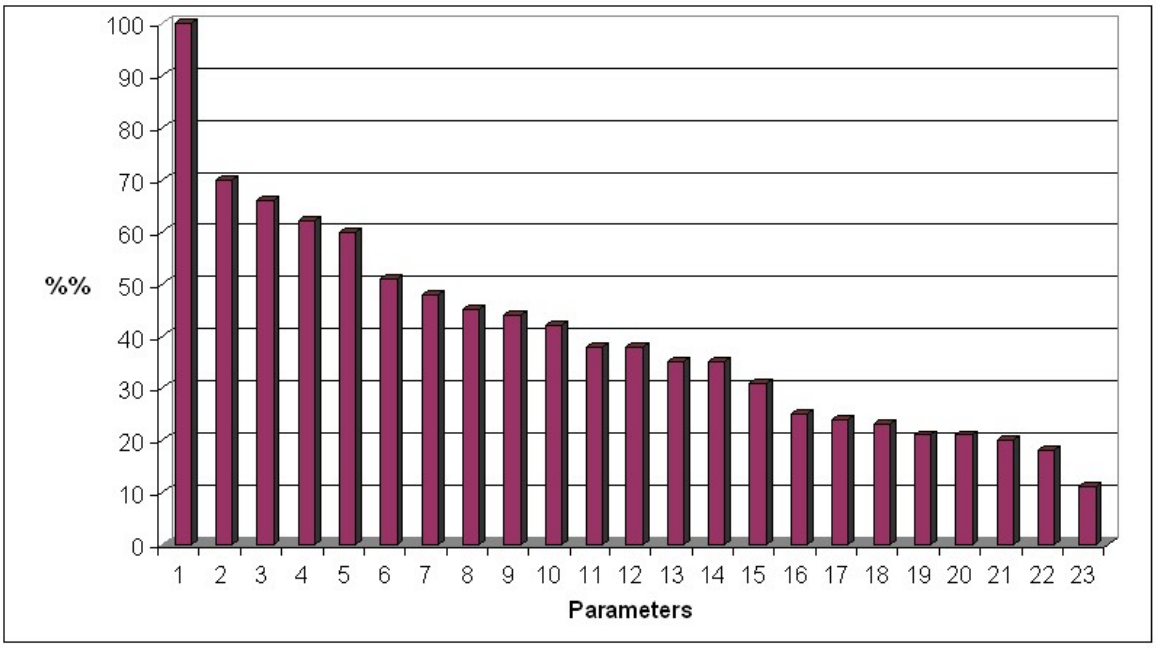

Fig.15. Correlation importance of the measured parameters concerning success of competitive activity for group of 196 athletes in sports with big physical activities for two years.

1 - GDV JS L; 2 - POMS depression; 3 – level of health, %; 4 - GDV JS R; 5 - GDV JS L; 6 - POMS dissapointment; 7 – yellow body mass; 8 – GDV entropy R; 9 – immunity level; 10 – dynamometry L; 11 – diastolic pressure, mm Hg; 12 - GDV JS R; 13 – GDV entropy L; 14 – GDV index; 15 - POMS activity; 16 - POMS patience; 17 – body mass; 18 - dynamometry R; 19 - height; 20 – body fat %; 21 – heart rate; 22 – systolic pressure, mm Hg; 23 – socialization level. R and L indexes refer to the right and left hands accordingly.

Successful results of approbation of developed methods of the psycho-functional state analysis give the grounds to consider that selected complex of the methods essentially increases reliability of the functional assessment of level of competitive reliability of athletes and has prognostic value. The important factor defining the importance of developed methods in sports of the highest achievements is the revealed connection of parameters with genetic predisposition of psychophysical endurance. This significantly increases prognostic value of the revealed group of parameters in selection of athletes of the Olympic reserve and their specialization in sports.

Developed approaches allowed transferring to prognosis of competitive success based on energy parameters of individual athletes.

The experiment was carried out in the training camp, before spring championship of Russia in shooting sports in Krasnodar. 43 athletes took part in research – the members of the junior national team of Russia and a national team of Krasnodar Territory. On the basis of the

received data, results of performance of leading athletes of the junior national team of Russia were predicted.

In this research the parameter of the integral area «JS» calculated in the "GDV Diagram" program characterizing the general intensity of energy emission in all functional systems of an organism was used as the key parameter. The analysis of connection of this index with the values characterizing features of the personality, self-control and the athlete's rating in the national team, allowed to establish significant correlations with the following indicators:

index of the general internality	r = 0.887;
aspiration to success	r = 0.846;
avoiding of failures	r = 0.821;
rating in the national team	r = 0.812;
internality of achievements	r = 0.789;
emotional stability	r = 0.785;
total factor of self-control	r = 0.781;
anxiety	r = - 0.724;
tension	r = - 0.711.

On the basis of the data received in research, the truthful forecast of success of competitive activity of shooters-athletes was made with 95 % significance value.

Differential peculiarities of shooting sports from high-speed and power sports and high dependence of successful performance in it on the general psychophysiological state of the athlete indicates the need of in-depth study of professional activity of athletes-shooters with application of GDV methods of a bioelectrography[9].

The group of psychologists carried out research of the military personnel having characteristics of disadaptative frustration. Manifestations of disadaptative frustration included: low level of psychological stability, high level of the situational uneasiness, and the expressed accentuations of character with behavioural disorders and abnormalities of the emotional and willpower sphere on prenozological level.

Following techniques were used:

GDV bioelectrography;

a number of the verified psychological blank and projective methods applied in system of psychophysiological support in Russian Army for an assessment of a psychological state and the mental status of the military personnel:

multilevel personal questionnaire "Adaptability",

DAB questionnaire (deviant, addictive behavior),

questionnaire "Forecast",

Lyusher's test,

psycholinguistic method of the phonosemantic texts analysis (FSA) .

In the penal colony the research with the purpose of development a method of an assessment of the persons inclined to asocial forms of behavior with use of bioelectrographic indicators was carried out.

Research tasks included:

1. Carrying out the experiment on the various contingents of persons with the GDV method and the set of the standardized psychological and psychophysiological methods for definition of bioelectrographic correlates of the indicators reflecting psychological and psychophysical features of the surveyed people.

2. Revealing the risk group of the persons inclined to committing the illegal actions, to aggressive and destroying behavior, to commission of asocial acts, to addictive behavior and their bioelectrographic features with the help of bioelectrography GDV method.

Methods of the hierarchical cluster analysis and the canonical correlation analysis were used for statistical analysis.

As a result canonical correlations were received, which unequivocally testified that there is a distinct statistical connection between studied groups of variables. The correlation factor of the first canonic linear combinations was 0.913, and the significance value (p-value) was 0.023. Therefore, the statistical importance of correlations is more than 97 % with $p < 0.03$. Individual correlations are presented in tab. 4.

Table 4.

Results of multidimensional regressive and dispersive analysis of GDV parameters and psychological characteristics.

Psychological characteristic	Factor
Uneasiness	R =0.521
Aggression	R=0.656
Reliability	R=0.601
Self-control	R=0.601
Willpower control	R =0.683
Tendency to dependent behavior	R =0.701
Tendency to overcoming of norms and regularities	R=0.712
Ethic normalization	R =0.675
Tendency to asocial behavior	R=0.714

The carried out estimation of efficiency of the received models has shown their reliability and informational value and accordingly high prognostic reliability.

Thus, as a result of the above-stated researches it has been shown that GDV method gives the valuable diagnostic information on the person's state, related to individual psychological features.

For revealing in GDV-researches of sportsmen the importance of the parameters measured under programs POMS-test and "Sport rating", the group of 27 highly skilled sportsmen has been selected.

Let's enter symbols of measured variables and factors used in the description and the analysis of the empirical data in given research:

Symbols of measured parameters:

SCA – success of competitive activity was measured on the results of participation in competitions.

For the analysis the following medical and physiological indicators of a functional state of examinees were used:

HR – heart rate (bpm).

BPS –systolic blood pressure (mm of vacuum).

BPD –diastolic blood pressure (mm of vacuum).

BPP –pulse blood pressure (mm of vacuum).

BPA – average blood pressure (mm of vacuum).

FE – factor of endurance;

FEBC – factor of effectiveness of blood circulation.

GDV-gram indicators of a bilateral contour of regulation of psychophysiological conditions:

R – indicators of the right hand fingers;

L – indicators of the left hand fingers;
R\L – ratio of indicators of the right and left hand;
R-L – difference of indicators of the right and left hand.

"Sport rating" program indicators:

IR – an index of a rating of the examinee; a range place of the athlete in the surveyed group of examinees on DPRlevel in comparison to the other members of studied group (the higher IR, the higher DPRlevel).

FEB – functional and energetic balance; index of bilateral symmetry of GDV-grams indicators of the right and left hands of the surveyed;

ED – energy deficiency; the energy deficiency indicator in the state of the examinee at the moment of inspection (for example, state of being too much trained, state of stress, illness and so forth).

POMS-test parameters:

T – anxiety (T factor - «tension – uneasiness»);
D – despondency (D factor – «depression – oppression»);
A – aggression (A factor «anger – aggression»);
F – fatigue (F factor «fatigue – inertness»);
C – uncertainty (C factor «uncertainty – confusion»);
PEN – the general integrated indicator of a psychofunctional state of the examinee according to total POMS-test data.

Parameters of patterns of GDV-grams diagnostics:

GDV-grams data consisted of 11 parameters (the area, factor of a form, average radius of the isoline, the Least-Mean-Square-Deviation isoline radius, length of the isoline, entropy of the isoline, quantity (N) of intervals of entropy, average intensity, quantity of fragments, fractality of the isoline, Mean-Square-Deviation of fractality). Data were calculated and quantitatively analyzed in the 4th options:

1. average values of these parameters for fingers of the left hand (11 values designated everywhere further as «Av. GDV-parameters of L»);
2. average values of the same parameters for fingers of the right hand (11 values designated everywhere further as « Av. GDV-parameters of R»);
3. difference between the right and left hands (11 values designated everywhere further as «R - L»);
4. ratio of right to values left hands values (11 values designated everywhere further as "R/L").

For this group of examinees the multiple correlation analysis of the received data was carried out.

Results of the analysis of psychophysiological indicators:

As we see from the data in tab. 8 significant correlates for SSA indicator – success of sports activity, are all GDV-parameters: Av. GDV-parameters of L; Av. GDV-parameters by R; R–L; R/L, and also program indicators «Sports Rating»: IR – an index of a rating of the athlete; FEB – functional and energetic balance or an index of bilateral symmetry of indicators of GDV-grams of the right and left hands of the examinee; ED – an energy deficiency state. On fig. 24 the dispersion schedule in model « SSA and Av. GDV-parameters of L » is presented.

Peculiarities of HR of examinees – the heart rhythm, are distinctly diagnosed on the GDV-grams indicators: Av. GDV-parameters of L; Av. GDV-parameters of R; R–L; R/L.

From 20 indicators of correlations of blood pressure and GDV-parameters 9 are representative for GDV-diagnostics.

The FEBC indicator – factor of effectiveness of blood circulation significantly correlates with an indicator (R-L), i.e. with a difference of indicators of GDV-grams of the right and left hands of examinees.

The FE – factor of endurance appeared in this case not informative.

Table 8.

Results of multiple correlation GDV-analysis of psychophysiological indicators (n=27) (r > 0,38 are significant at $p < 0,05$).

Below results of GDV data regression analysis of a selection of 100 qualified athletes are presented. On fig. 25 the dispersion schedule for model «Classification and GDV-parameters» is presented.

On the basis of given in tab. 8, 9 data can be believed that the GDV method of a bioelectrography allows to judge quite authentically about the psychophysiological state of the athlete at the moment of inspection, in particular this method allows to characterize rather authentically the state of bioenergetics of the athlete, traditionally estimated by indicators of the blood pressure and self-estimation of health of the athlete at the moment of inspection.

Procedure of GDV-gram diagnostics can be combined with enquiry (anamnesis) of the examinee, in the course of which the experimenter can ask questions on health and level of claims of the surveyed athlete concerning the result in the forthcoming sports competitions. The data in the tab. 9 open the picture of psychological structure of the personality of the examinees, received by means of GDV-diagnostics. GDV-diagnostics results reveal the most sensitive GDV-grams elements to indicators of the POMS test. So, according to data of the multiple correlation analysis the most sensitive indicators are “GDV-parameters of L”, and authentic correlations are observed with five of seven factors of the POMS test. The very sensitive GDV-parameters to indicators of the POMS-test are indexes of bilateral ratios (R/L) and (R-L).

Table 9.

Results of multiple correlation of GDV-grams indicators and results of the POMS-test

Comparison of correlation connections of parameters of the POMS test and GDV data in the group of young athletes and in the group of highly skilled athletes show that the higher the skill level of the athlete, the more prominent and unequivocal are the GDV-indicators.

Comparison of data to success of competitive activity and discussion it to trainers showed that the rating made according to instrument measurements, more precisely corresponds to competitive productivity and the expert assessment of trainers in comparison with results of the POMS test.

It is connected with high subjectivity and a certain negligence of filling of the POMS test protocols by young athletes, that induces to make the conclusion about low efficiency of use of biographical techniques for research of groups of young athletes in comparison with instrument methods.

In the same time for the high-class athletes who seriously concerns the filling of protocols of testing, application of a blank technique of POMS is quite adequate and obtained data bear information on a psychological profile of important sports features of the athlete.

Conclusions:

1. The above mentioned experimental data give good reason to assert that the quantum-field level of organism’s bioenergetics, as well as the substrate level, is subject to genetic determination. Substrate level involves biochemical aerobic and anaerobic processes providing

muscle activity. Quantum-field level is determined by electron-photon levels of stimulation of molecular and structural ensembles revealed by the GDV-method[10].

2. Functional dependencies between the evoked emission processes' parameters, genotype characteristics of athletes, and the sport activity effectiveness determine diagnostic importance of GDV parameters for the creation of system of early sport specialization and screening control of highly skilled athletes' psychophysical potential.

3. Diagnosis of an individual's psychophysical potential according to GDV parameters cannot be reduced to using a single (even integral) GDV-gram parameter, and hence should be implemented using a complex parameter assessment based on multiple correlations.

4. GDV-grams patterns of fingers of the right and left hands of athletes of high qualification have the specific characteristics correlating with the psychoemotional status and psychophysical readiness of athletes to competitive activity.

5. Fingers of the left hand of athletes possess the highest sensitivity to scanning the GDV-grams patterns.

6. The results of research of the system homeostasis and GDV-patterns transformation during mental modeling of readiness of athletes to competitions give the grounds to assume the high-informative importance and prospects of use of the modern GDV-technology in sports psychodiagnostics.

7. The results of the carried-out researches allowed recommending the technology of gas discharge visualization for the use for the purpose of forecasting of readiness of highly skilled athletes in sports with physical endurance.

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