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Investigation of athletes' health disorders risk models

Kerimov Fikrat Azizovich[1], Narzullaev Davronbek Zikrullaevich[2], ✉
Tursunov Alisher Tulkunovich[2],Yomgirov Gaffor Bobosharipovich[3],
Karimov Bekzod Boyqobilovich[3]
[1]Uzbek state university of physical education and sport, Tashkent, Uzbekistan,
[2]Tashkent pharmaceutical Institute, Tashkent, Uzbekistan,
[3]Karshi state university, Karshi, Uzbekistan

Abstract
Purpose: Development and theoretical-experimental substantiation of the risk model for the health impairment of athletes in order to further automation of the process of training highly qualified athletes, as well as optimizing the construction of the training process based on the use of innovative technologies that increase its efficiency with optimal expenditure of time and energy of athletes.
Methods: Retrospective analysis of applied automation and modeling methods, questionnaires of athletes and coaches, sports testing, applied pedagogical experiment, methods of mathematical statistics.
Results: Students of physical culture universities (athletes) are more likely to encounter syndromes that characterize a violation of the mental state of an asthenic, hysterical, psychoasthenic, neurotic nature than with somatic syndromes ($p<0.05$). Of these, the proportion of mental syndromes is 11.5% and 11.3% (asthenic and hysterical). Otorhinolaryngological, vegetative-vascular and cardiovascular syndromes are more common in the somatic sphere of students' health.
Conclusion: On the basis of the proposed method, a risk model for the health of athletes was developed and theoretically-experimentally substantiated, which allows diagnosing, monitoring health and determining risk groups among students of sports universities and faculties. Experimentally proved that the advantage of the proposed approach is the speed and the ability to examine a significant number of contingents of different ages.

Keywords: mathematical model, health risks, risk factors, health assessment.

Introduction

Analysis of the risks of athletes' health disorders under the influence of various environmental factors is one of the most relevant, fastest interdisciplinary aspects of modern science and practice (1-3). Depending on the state of health in each of the countries, students belong to the category of increased risks (4-8). Information-examination stress, violation of rational nutrition, physical inactivity, lack of proper academic work, rest and bad habits are risk factors for students' health, contributing to an increase in morbidity during study at an educational institution and the development of psychosomatic disorder (9-12). In just 10 years, the number of cases of students has increased by 35 percent. According to literary sources, on average, during the years of study at the university, the number of healthy students decreases by 25.9%, chronically ill - increases by 20.06%. As noted, by the end of their studies at the university, every second student has chronic diseases, and the number of healthy individuals is no more than 10-15 % (4). Basically, the period of adaptation of students falls on the first and second courses, where the probability of a maladaptive state is especially high (13-17). The most relevant issue is the involvement of students of the sports university in the educational process. This is due to the fact that in such universities, training is distinguished not only by high mental and significant psycho-emotional, physical activity. At the same time, there is a positive influence of adaptive capabilities and physical development of the body on properly organized sports. At the same time, the level of psychosomatic states of students of the physical culture university remains poorly studied today (1, 3, 18-21).

Nowadays, health diagnostics is based on the use of numerous functional tests that require time and equipment. The results of such tests do not always correspond to the assessment of an individual's condition. Thus, the development and application of methods for assessing the student's health and the risks of its violation in order to diagnose prenosological diseases becomes relevant. A promising approach to risk assessment and management, including those related to health disorders, is to use mathematical models that allow saving material and time resources.

Methods

300 students of sports educational institutions were involved in the experiment. All students are residents of Uzbekistan, some were members of the national teams of Uzbekistan in various sports. Athletes were included in the study

if they were healthy (without health problems or without symptoms of infection during the 2 weeks preceding the examination) and trained regularly. Athletes with a history of chronic infectious or non-infectious diseases (diseases of the heart, liver, kidneys, lungs, nervous system, gastrointestinal tract, etc.) were not included in the study. In order to find out the relationship between the level of health according to the indications of the psychosomatic syndrome determined during the questionnaire, methods of correlation analysis were used. The calculations were carried out using the statistical data analysis software package SPSS. The data obtained using the "Decision Tree" method made it possible to build models of the risk of health disorders in young people who play or do not play sports. The use of such models made it possible to carry out diagnostic studies, health monitoring and identification of risk groups in students without special equipment.

Results and discussion

Basically, the period of adaptation for athletes is 1-2 years of training, in which the probability of a maladaptive state is especially high. In order to assess the health of 300 2nd and 3rd year students of various sports faculties, questionnaires and other methods were used to assess the state of health (2, 3). Qualifications of athletes: 1st category - 44.6%, candidates for masters of sports - 37.6%, masters of sports - 17.8%. The physical condition of 65 athletes and 35 young men not involved in sports was studied.

To assess psychosomatic states, the method of quantitative assessment of human health was used. The questionnaire "Health assessment" included six blocks of questions to identify mental health disorders and eight blocks of questions to identify disorders of the somatic field of otolaryngology, liver damage syndrome, heart, etc. The questionnaire is supplemented with four sections: anemia, allergy, infection and autoimmune syndrome. Each studied syndrome was evaluated in points using two parameters: frequency of manifestations - absence - 0, rarely - 1, often - 2, constant - 3, degree of manifestations - absence - 0, weakness - 1, moderation - 2, strongly - 3. Based on the information received, the integral value of the sum of the frequency and strength scores, or the indicator of soreness, which is a characteristic of the state of distress of a particular block of the symptom complex, was calculated.

The methodology proposed in was used to assess the health of an individual, which included indicators of physical development of the Quetelet index, life index, strength index; the state of the cardiovascular system, heart rate, pressure, Robinson index - a double-action indicator; the time of return of heart rate after dosed training (3, 20). With the help of this technique, a fairly complete and reliable idea of the state of the body is obtained, and it is possible to predict the risks of diseases.

Determination of the relationship of physiological health with psychosomatic indicators was carried out by methods of correlation analysis.

The results of the test survey show that students of physical education universities were more likely to encounter syndromes that characterize a violation of the mental state of asthenic, hysterical, psychoasthenic, neurotic character than with somatic syndromes ($p<0.05$). Of these, the proportion of mental syndromes was 11.5% and 11.3% (asthenic and hysterical). Otorhinolaryngological, vegetative-vascular and cardiovascular syndromes were more common in the somatic sphere of students' health.

As a result of the study, it turned out that young athletes in comparison with those who do not play sports are less likely to register mental state syndromes.

Psychoasthenic (7.0%) was often observed in young athletes, asthenic and hysterical syndrome - in non-athletes.

Only people with a high level of physical health have a safe somatic level of health, which guarantees the absence of diseases (3). The average degree of physical activity can be considered as critical. A further decrease in the functional level already leads to a clinical mani-

festation of the disease with appropriate symptoms.

The results of the correlation analysis showed the following: a strong relationship (r = 0.81) of indicators of cerebroasthenic syndrome with the level of physical health of young athletes, an average relationship (r= 0.6) - the level of physical health of young athletes with indicators of otorhinolaryngological, anemic and psychoasthenic syndromes.

A strong correlation (r= 0.72) of the level of physical health with indicators of vegetative-vascular syndrome was revealed in young men who do not engage in sports, an average correlation was found with indicators of neurotic, infectious, allergic and asthenic syndromes (r = 0.52).

The data on the relationship between the health indicators of physical and psychosomatic syndromes in students engaged and not engaged in sports were used to create models of the risks of physical impairment.

Using the "Decision Tree" method, six rules have been defined that indicate at what value of individual symptoms there are or are not risks of athletes' health disorders.

93% of syndromes are correctly classified, which indicates a fairly high quality of the model. Below is an interpretation of this model. Athletes risk health problems when combined with the intensity of the following type of syndromes (see figure 1):

1. Cerebroasthenic syndrome - more than 26 points, and the indicator of anemic syndrome is more than 23 points.

2. Cerebroasthenic syndrome - less than 28 points, and the indicator of psychasthenic syndrome is more than 31 points and vegetative vascular syndrome is more than 11 points.

3. Cerebroasthenic syndrome - less than 27 points, psychoasthenic syndrome - less than 31 points, and otorhinolaryngological syndrome - more than 15 points.

4. Cerebroasthenic syndrome – less than 27, psychoasthenic – less than 31 and otorhinolaryngological - less than 16 points.

Thus, the 12 model mesocycles of training of young judokas proposed in this paper in the first training year of primary training can significantly increase their effectiveness over a one-year period of training.

Using models of the risk of health disorders of young people who are not engaged in sports, 6 rules were revealed describing the totality of the values of the syndrome in which there is or is not a risk of a violation of a healthy state. At the same time, it is necessary to note the correct classification of 95% of syn-

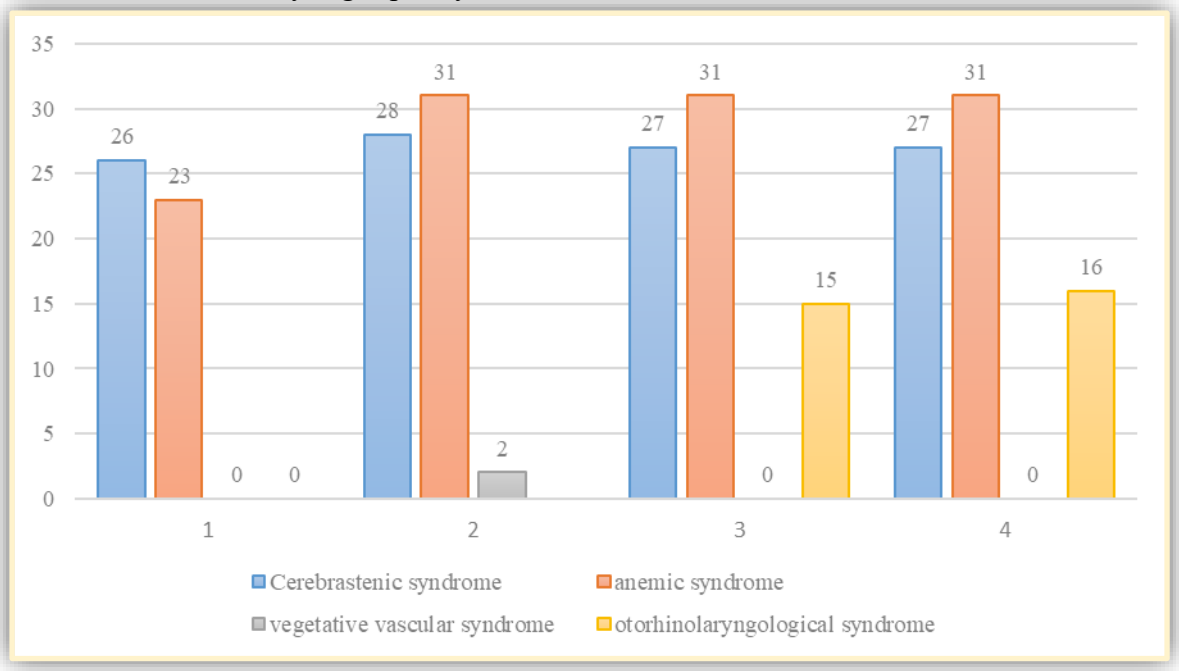


Figure 1. Risks of health disorders in combination with the intensity of syndromes.

dromes.

This model is interpreted as follows: young men who do not play sports are at risk of health problems under the following conditions:

1. The result of neurotic and vegetative vascular syndromes is more than 20 and 18 points.

2. The result of vegetative-vascular syndrome - more than 18 points, neurotic syndrome - less than 20 points, asthenic syndrome - more than 12 points.

3. The indicator of vegetative-vascular syndrome is less than 18 points, and infectious - more than 6 points.

4. Data of vegetative vascular syndrome - less than 18 points, infectious syndrome - less than 7 points, and allergic syndrome more than 8 points.

With the following combinations of indicators of syndromes, non-sports students do not risk health problems:

1. The values of vegetative-vascular syndrome are more than 17, and neurotic and asthenic syndromes are less than 20 or 12 points, respectively.

2. The indicator of vegetative-vascular syndrome is less than 18 points, and allergic and infectious syndromes are less than 8 and 7 points.

By the method of an express survey, it turned out that students of sports universities most often have syndromes of asthenic, psychoasthenic and neurotic states. The frequency of cases of the syndrome that characterizes the state of the psyche in young athletes is less than in untrained. In comparison with athletes, students who do not play sports have a higher frequency of severity of vegetative-vascular, otolaryngic, anemic and cardiovascular pathology.

When assessing the physical condition of the software, it was found that more than half of young people who play sports and three percent of students who do not play sports had a safe level of somatic health (2, 3). A critical state of physical health was registered with the same number in both groups of students. Low physical activity was determined 3-7 times more often than in athletes in young people who do not play sports.

Conclusion

Unfavorable trends in healthcare and an insufficient number of research publications related to the assessment of the health status of students, the risk of their violations indicate the need for research in this direction. The development of methods for individual assessment of the risk of health disorders of students contributes to the timely prevention and correction of its violations.

The use of the developed disease risk model makes it possible to diagnose, monitor health and identify risk groups among students without using special devices. The advantage of the proposed method is the speed of its action and the ability to examine a significant number of contingents of different ages.

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AUTHOR BIOGRAPHY



Fikrat Azizovich KERIMOV
Employment
Professor at Uzbekistan state university of physical education and sport.
Degree
DSc
Research interests
Sambo training, armwrestling, science of sport, education with master's student, swimming exercise's.
E-mail: info@jtsu.uz



Davronbek Zikrullaevich NARZULLAEV
Employment
Associate Professor at Tashkent Pharmaceutical Institute
Degree
PhD
Research interests
physiological and biomechanical principles, nutrition, including nutrition, Articles published in Sports medicine .
E-mail: davr1960@mail.ru

Alisher Tulkunovich TURSUNOV
Employment
Senior lecture at Tashkent Pharmaceutical Institute
Degree
MD
Research interests
Sports industry, career in sports, work experiences, sport with kids.
E-mail: tursunov_077@mail.ru

Gaffor Bobosharipovich YOMGIROV
Employment
Senior lecture at Karshi state university
Degree
MD
Research interests
Wrestling, handball, Track, Lane, Photo Finish, Hurdles, Shot Put.
E-mail: kardu@mail.ru

Bekzod Boyqobilovich KARIMOV
Employment
Senior lecture at Karshi State University
Degree
MD
Research interests
Physical training with kids, sport nutrition, structure of physical exercise's, published in Sports.
E-mail: kardu@mail.ru