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Features of the Preanalytical Stage of Genetic Studies in Sports Medicine

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ABSTRACT

Sports genetics is a topical area that allows athletes to achieve high results based on various methods developed in the course of scientific research. Gene polymorphism affects physical activity, performance, physical development of an athlete, and much more. This review article is devoted to the study of these circumstances of the relationship.

Sports genetics is a platform for making new decisions to create personalized training programs in order to achieve high athlete performance, as well as adequate selection for sports qualifications with minimal health risk [5; 4; 6; 7; 8]. As you know, sports genetics as a relatively young science, about forty years ago, at the Olympic Scientific Congress in Tbilisi, an international scientific society dealing with sports genetics and sports somatology was created. Then, in 1983, Professor and Head of the Department of Genetics and Nutrition. John Barton Sr. of Louisiana State University, USA Claude Bouchard coined the term "genetics of physical activity", where in two reviews published in the scientific journal "Exercise and Sport Science reviews" he presented evidence-based facts about the individual differences of athletes in response to physical activity and the role of inherited physical qualities involved in the process of physical activity [9; 10; 13].

Later, at the end of the 90s of the XX century, in the journal Human gene for physical performance, the British scientist Hugh Montgomery published an article on the role of the ACE gene in sports practice, where the polymorphism of the alleles of this gene, namely the I allele is responsible for endurance, the D allele for speed and power qualities of an athlete.

Sports genetics as a science is developing rapidly, the number of new studied genes is growing and more than 200 genetic markers responsible for the development and manifestation of physical qualities have been studied [2; 12].

In its structure, a person has unique genetically embedded information, which today it has become possible to study by DNA diagnostics. For a detailed study of the genetic material of an

athlete in sports genetics, the available method of polymerase chain reaction, etc., as well as biochemical and geniological methods are widely used [11; 18].

An analysis of the ADRB2 and ADRB3 genes will give an understanding of how the process of fat breakdown will occur and how effective weight loss will be depending on the intensity of physical activity. The ADRB2 gene encodes a beta-2-adrenergic receptor, a protein ion channel of the cytoplasmic cell membrane, which has a high degree of affinity for framerenaline and provides an increase or decrease in the metabolic activity of the innervated tissue or organ, and its activation increases the intensity of glycogenolysis; two polymorphisms have been studied - Gly16Arg (associated with cardiac output at rest, increased bronchodilation and endurance) and Gln27Glu (associated with obesity and glycogenolysis, glycogen breakdown during physical activity), the 27Glu (G) allele is associated with receptor changes and slow glycogen breakdown [13; 14].

In turn, the ADRB3 gene encodes a beta-3-adrenergic receptor, which acts in adipocytes through which, under the influence of catecholamines, lipolysis and thermoregulation occur, while the maximum expression of the gene is observed in the ovaries, placenta, and gallbladder. Polymorphism in the gene slows down the process of fat burning and is associated with the development of such diseases as hypertension, diabetes mellitus, and obesity [15; 17].

The significance of the problem of achieving high results in competitions is determined primarily by the innate characteristics of the organism. It is the possession of genetically programmed data, such as the type of temperament, ADRB2, ADRB3 genes and its genotypic allelic variants [1; 3], which are important components of the sympathetic nervous system, largely determine the physical condition and fitness of an athlete. In this regard, the development of additional clinical and instrumental studies that are not included in the standard in-depth medical examination is of considerable scientific interest for the practice of selection in sports sections.

According to numerous studies conducted for sports orientation, it is necessary to study the innate characteristics of an athlete and select an adequate sport for him. Along with medical-pedagogical, sociological methods of studying the individual characteristics of an athlete, it is undoubtedly necessary to use genetic and morphofunctional methods [17; 18].

As modern studies show, the wrong choice of sports specialization contributes to the slow growth of sportsmanship and can cause a deterioration in the health of an athlete [20; 22]. The totality of all hereditary inclinations (genotypes) and the totality of all the characteristics of the body (phenotypes) are determined by both inherited properties and the effects of physical activity, which makes it possible to avoid many mistakes in terms of selection for sports sections and the choice of adequate methods in the process of training sessions. At present, certain success has been achieved in the search for genes that switch fat metabolism from the formation of white fat, which is stored in reserve, but the isolation of individual genes or their complexes is a very laborious and poorly developed process [9; 18]. In the sports practice of sports, an important role in the selection of gifted youth is given to the use of so-called markers that reflect the hereditary inclinations of individual individuals, with the help of which it is possible to identify genetic inclinations at the early stages of a child's development. For sports orientation and selection, genetic markers can be used in the search for athletes with body traits adequate for a given sport [8; 11].

In order to prepare a high-class athlete, without harm to his health, it is currently possible using the most informative genetic markers that allow differentiating athletes in each individual sport [12; 13].

As is known, the regulation of the sympathetic activity of the nervous system occurs under the influence of the adrenergic receptor β-2A type and is involved in the adaptation of the

cardiovascular system of sports, changing blood pressure and heart rate under the influence of physical exertion of sports [11; 15].

Numerous studies in the field of genetics have determined that β-2 adrenergic receptors are expressed in many cells of the body, are involved in the regulation of not only the functions of the cardiac system, but also the pulmonary, endocrine and central nervous system, this adrenergic receptor of sports also stimulates the breakdown of triglycerides. The ADRB2 gene has a functional Gly16Arg polymorphism (G/A), which has a high relationship with the physiological and processes of the sports organism, the allele is associated with low receptor density and low cardiac output at rest, reduced bronchodilation (Snyder H. et al., 2006), low the level of systolic blood pressure (Snieder H. et al., 2002) and a low risk of obesity (Masuo K. et al., 2006).

According to the results of studies within the framework of the "GenathleteStudy" project, data were obtained on the high frequency of occurrence of the 16Arg allele in elite stayers in a comparative characteristic with the control group (Wolfarth B. et al., 2007).

The ADRB3 gene is located mainly in adipocytes, vessels, smooth muscles of the digestive tract, in the prostate gland, skeletal muscles, and gallbladder and encodes β-3 adrenoreceptors [9; 13].

In their research, Clement et al. We found a link between the Trp64Arg polymorphism of the ADRB3 gene and an increase in human body weight; it was noted that carriers of the mutant allele in the obese group (heterozygous genotype) tended to constantly gain excess weight [7;10].

Also by the Walston et al. It was found that in the Pima Indians, carriers of the homozygous variant of the ADRB3 gene allele have a history of type 2 diabetes mellitus and develop this disease quite early in life, the metabolic rate of these patients is very slow, the researchers hypothesized that the mutation may accelerate the onset of this disease , disrupting the balance of energy consumption in visceral adipose tissue [14; 19].

Kim-Motoyama et al. In their studies, they determined the relationship of Trp64Arg polymorphism with visceral obesity, in individuals with an increased body mass index, the mutation was more common, and the mutant homozygote Arg64Arg (SS) was more common in the group with a reduced level of serum triglycerides, the scientists concluded that the mutation leads to a decrease in lipolysis in visceral adipose tissue [5; 8].

Along with medical-pedagogical, sociological methods of studying the individual characteristics of an athlete, it is undoubtedly necessary to use genetic and morphofunctional methods.

As modern studies show, the wrong choice of sports specialization contributes to the slow growth of sportsmanship and can cause a deterioration in the health of an athlete.

In such a sport as swimming, morphological features have a great influence on the giftedness and prospects of athletes, as well as record achievements, thereby causing different adaptation to various conditions of activity, which together affects the selection of the most talented athletes. Anthropometric data directly affect success in competitive activity, because physical qualities are directly proportional to physical performance. In this regard, the sports selection of promising athletes is a set of measures to identify talented athletes with a high level of abilities that meet the requirements of the specifics of this sport.

Also, the analysis of literature data shows that at present, studies devoted to the features of the anthropometric phenotype, psychophysiological characteristics, analysis of port gene polymorphism in people involved in physical culture and sports are one of the current trends in modern sports practice. Underestimation, in modern sports theory and practice, of the value of the contribution of the genetic factor to the successful growth of sportsmanship when choosing a

sport, sports specialization and style of competitive activity leads to the formation of an irrational functional system of adaptation of the athlete's body, with many unnecessary intrasystem and intersystem relationships, compensatory reactions, with constant emotional stress, creating a risk of health and slowing down or even stopping the growth of sports results.

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