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A MOLECULAR GENETIC METHODS FOR EVALUATING ATHLETES' ABILITY (REVIEW ARTICLE)

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Summary: Sports genetics is still in its early stages, but it opens up many opportunities for the development of medical and biological support for athletes. Using the body's genetic features will propel humanity to new heights, because the athlete's "Olympic" heredity is now as vital as his tenacity, regular training, willpower, and motivation. A thorough examination of these genes is required for the effective organisation of the training process and the prediction of athlete skills. Our country places a high value on the growth of professional sports. Athletes' performance in high-level events is a key component of the country's international standing. In this light, the situation regarding the necessity of athletes' health in achieving great sports performance has become particularly relevant.

Key words: Athlete performance prediction, athlete selection, and DNA polymorphism, cadet and junior athletes.

One of the most important theoretical and applied medico-biological challenges in physical culture and sports medicine is the creation of sports selection theory, which defines the degree of sports achievement and sports science in general. Scientific study has demonstrated that the optimal health indicators of athletes are based on the state of dynamic equilibrium between the functional reserves of the body and the factors impacting them. [1; 9; 22; 23]. At the same time, the magnitude of the influence of the factors that are inherent in the modern system of training athletes on the body of those involved increases in proportion to the stages of their professional development, which requires not just optimal health indicators, but the presence of an appropriate level of reserves of functions of its components [7; 12; 27]. The value of the latter is the basis of the athlete's reliability - an indicator that is characterized by high performance of actions and its stability in extreme conditions of activity [5]. In this regard, there is a consensus among specialists that athletes-children and adolescents have the lowest reliability coefficient, since it is this contingent of those involved in sports that has certain prerequisites for the development of maladaptive disorders in somatic systems, the structural elements of which are included in the newly formed system of adaptation of the body to muscular activity [13; 16; 20; 25].

These prerequisites include specific features of the structure of the child's body, biochemical processes and functions in general, as well as individual organs, in which qualitative (development) and quantitative (growth) changes occur at various stages of ontogenesis [2; 12; 18]. In addition, the inconsistency of regulatory systems and the heterochronism of growth and maturation processes only exacerbate the problem of the development and progression of pathological deviations in the somatic systems of the body of young athletes with an irrational structure of the training process, which is confirmed by the data of scientific research on the morbidity of children-athletes [3; 11; 21]. Regardless of the preventive and therapeutic measures taken, the number of somatic diseases among reserve athletes does not statistically decrease [13; 20; 26], which allows us to state the presence of a number of issues, the solution of which is associated with the development of the concept of physical rehabilitation of young athletes with dysfunctional disorders of the somatic systems, mediated by training and competitive activities.

Scientific substantiation and development of conceptual, organizational and methodological components of this concept is impossible without a detailed study of the health status of

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athletes of a particular specialization, without taking into account the characteristics of the biological, psychosocial and professional stages of ontogenesis. In the classical practice of sports medicine, it is generally accepted that all preventive, therapeutic and rehabilitation measures should be carried out on the basis of data from an in-depth medical examination of athletes, the resulting component of which is a conclusion on the admission of the examined to training activities [5; 15; 24]. The admission is carried out according to the following criteria: “healthy”, “practically healthy”, “requires limitation (full or partial) of training activity”. But it follows from practical experience that the data obtained are sufficient for carrying out therapeutic and rehabilitation measures for a specific athlete, but not enough to substantiate the organizational and methodological foundations of the system of measures aimed at protecting the health of a vast contingent of athletes, especially during critical periods of ontogenesis.

At present, most of the sports games can be defined as disciplines "mixed energy system" [1], in which effort has intermittent characteristics with the participation of both aerobic and anaerobic metabolic pathways [2]. In this regard, physical fitness is one of the most important elements that affect the performance of athletes from mixed sports due to the high physical load due to intermittent activity [3]. Indeed, strength and endurance can be considered the key fitness elements for mixed sports such as football, wrestling and motorcycling [4, 6]. All of these sports have been classified as mixed in terms of their metabolic predominance, thus showing the general multifaceted nature of physical demands, which include aerobic capacity, strength, endurance, strength and agility [4, 6]. However, descriptive studies indicate that the physiological characteristics of an athlete can vary greatly across these disciplines, suggesting that there are different sport-related profiles in terms of the relationship between endurance and speed. Athletes from mixed sports disciplines do not have a clear focus on endurance or strength, thus demonstrating wide phenotypic heterogeneity [7]. It is common knowledge that genetic factors influence sprint / strength and endurance [21, 23]. , but only a few studies have examined the relationship between genetic factors and athletic performance in mixed athletes. Among the potential polymorphisms potentially associated with muscle function and physical performance, the most studied are angiotensin-converting enzyme (ACE), variant R577X of the actinin-3 gene (ACTN3), and muscle creatine kinase isoform (CK-). MM), peroxisome proliferator-activated receptor α (PPARα), and more recently SLC2A4 [9, 14]. It has been demonstrated that alternative polymorphisms of these potential polymorphisms are associated with sprint / strength or endurance disciplines with reasonable replication in different groups of athletes [15, 18]. Indeed, the I allele of the insertion (I) / deletion (D) polymorphism in the ACE gene is one of the most putative factors determining aerobic capacity in performance-oriented endurance [8]. Likewise, the PPAR-G, ACTN3 X, and CK-MM A alleles are involved in improving aerobic performance [16, 17, 19]. On the other hand, it is assumed that ACE D, PPARN C, ACTN3 R and CK-MM G are more related to strength-oriented characteristics [8, 16, 20]. Given that the contribution of specific genes to athletic performance has been investigated primarily in athletes who are at the two endpoints of the human athletic performance continuum, less is known about the application of sports genomics in more complex disciplines that do not exhibit specific phenotypes. Thus, the aim of the present study was to compare the allele and genotype frequencies of four known polymorphisms in athletes from various disciplines of mixed sports in order to investigate the genetic markers suitable for distinguishing between the predominant components of these sports [25, 26].

One of the rapidly developing areas of modern genetics is the development of molecular genetic approaches to determine a person's predisposition to various types of activity. So, in

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particular, in recent years, a search has been carried out for molecular genetic markers that determine a person's ability to perform high sports loads (Montgomery, 2000; Rogozkin, 2004), which is determined by the need to justify a system for selecting people for sports and correcting the training process. This approach is the most promising, since it allows you to determine the genetic predisposition to high physical activity and to carry out a targeted differentiated selection of children for sports at the earliest stages of their sports activity. It should be noted that in 2000 a human genetic map was created, in which genes were introduced, which in at least one study revealed associations with physical indicators and / or influenced human health (Rankinen, Bray et al, 2006). In an early 2000 version, the map included 29 genes. The 2005 version, 6th - amended, includes 165 autosomal genes, 5 - located on the X chromosome, as well as 17 mitochondrial genes. To date, work of this kind is being carried out only in five countries: the USA, Great Britain, Australia, Russia (Scientific Research Institute of Physical Culture - under the leadership of Doctor of Biological Sciences, Professor V.A. Rogozkin; laboratory of molecular genetic research of the Department of Genetics at the Bashkir State Pedagogical University - under the leadership of Doctor of Biological Sciences, Professor Gorbunova V.Yu.) and Kazakhstan. On the site 4 www.genoterra.ru - the register of leading scientific institutions, the laboratory of molecular genetic studies of the Department of Genetics of BSPU is included in the list of groups engaged in the search for genetic markers that determine the predisposition of people to sports activities [27].

Thus, it becomes clear that, from the point of view of health savings, it is of particular interest to study not just the health state of young athletes, but a comprehensive level-by-level screening of the functional state of the athletes. This type of layer-by-layer "screening" will allow to determine the corrected risk factors for the development of somatic pathology in athletes within the framework of uncorrected factors (determinants), in this case it is sports specialization and a stage in the process of many years of training.

According to the research of Svetlana Lyugailo (Results of studying the health status of young athletes: the first level of screening studies) _ using classical approaches to assessing the health status of young athletes, on the basis of the existing criteria for their admission to sports, the previously determined trends in the influence of ontogenetic risk factors for the emergence and development of somatic pathology in the age aspect and in the aspect of professional development. At the same time, a number of negative points were established:

- firstly, despite the presence of diseases and dysfunctional disorders in the somatic systems, athletes continue the training process, which indicates insufficient control over the functional state of the trainers and medical workers, who provide the process of training young athletes directly at the place of training;
- secondly, despite the comprehensive examination provided for by the algorithm for conducting an in-depth medical examination, the information obtained regarding the health status of athletes is not sufficient for making a rehabilitation diagnosis, since it is impossible to draw a true conclusion about the adaptive capabilities of the body of a young athlete to physical activity from the data obtained, to obtain quantitative characteristics of the parameters that form the adaptation reserve and, moreover, to forecast the occurrence of dysfunctional disorders in various systems of the athletes' body.

The above organizational miscalculations in the development of the structural components of the concept of physical rehabilitation for dysfunctional disorders of the somatic systems of the body of young athletes (somatic diseases) will be taken into account in the group of exogenous corrected risk factors for diseases in athletes.

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