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Importance of the Anthropological and Genetic Criteria Involved in Sporting Selection

Neluța SMÎDU¹

Abstract

The researches made in the field of performance sports showed that performance is due 70% to selection and only 30% to training. So, getting top results is possible only for sportsmen with exceptional genetic equipment and special abilities. This work approaches two relevant criteria of the sporting selection, the anthropological and the genetic criteria. These criteria are the only ones to allow us to scientifically foresee the evolution of the biotype and if it shall become an optimum anthropological type for the sporting branch in which it has been selected. At the same time, guiding the training based on knowing the individual anthropological particularities of each sportsman leads to increased sporting efficiency. The selection implies a broad conceptual and organizational assessment action on different levels (anamnesis, diagnosis of the health state, level of physical and functional growth and development, psychic availability etc.) of large groups of children and juniors. It is a process organized and repeated to discover early the subject's inborn availability so that he/she may practice and specialize in a sport discipline or event afterwards. The genetic and anthropological selection criteria broadly result from the medical and sporting anamnesis, containing both personal, and hereditary-collateral antecedents (child and parents' morphological configuration, cultural, educational level, parents and child's attitude towards sports, family sporting antecedents, psychomotor behavior, IQ etc.). The assessment of the potential in sports is made by anthropometric exam, which is a physical growth and development measurement method based on measuring the body, the somatic indexes (nutrition indexes, harmony indexes, force index) concerning various segments or even the whole body.

Keywords: *selection, genetic criteria, anthropological criteria, performance sports, somatic indexes.*

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1. Introduction

Selection is an organised and repeated process of early detection of the inbred availability to the later practice and specialisation in a sportive discipline or trial. Each sportive trial was described as a “performer’s ideal model”. This is called the “constitutional bio-type” and is characterized by certain motive, physical and behavioural features.

The selection uses a complex system of criteria for the identification of the subjects who come the closest to the ideal model. „The selection process requires organizational forms appropriate to the pursuit of a sustained and systematic work, being one of the factors that determine the value of performance” [1].

The complex criteria system through which the selection is done comprises the: cano-genetic criterion, anthropological criterion, somato-physiological criterion and genetic criteria. Selection can be primary, secondary and finale. The primary selection represents the moment the child enters, based upon some criteria, in the specialised sportive units. The second selection level is the secondary or puberty selection, its aim being the identification of the “biological micro-model” specific to the said sportive trial, and the last level is represented by the final selection, which actually marks the transition towards the performance sports, it being dominated by the criteria of the sportive performance value. Generally, it is applied to the national and Olympic teams and aims at the identification of the “biologic macro-model”.

„Due to the „acceleration” phenomenon, produced by good living conditions and by enhancing the degree of civilization, there are cases where selection is influenced by the early establishment of puberty, 9-10 years or its prolongation, up to 16-17 years, especially in boys” [2].

2. Theoretical Background

Worldwide, the issue of early selection and training of future high-performance players is becoming increasingly acute. More and more sporting branches lower the age of selection in the desire to achieve remarkable results as quickly as possible. For this reason, the application of genetic and anthropological criteria should always accompany sports selection.

The anthropological criterion is especially important for the selection of those organisms which superimpose themselves the best over the performer’s ideal constitutional bio-type in the respective sportive branch. For example, a weight-lifter is advantaged by the weight-centre placed as

lower as possible because it allows an increased stability, reason for which, in this sportive trial, the sportsmen who have the shortest inferior limbs will be selected. The upper short limbs allow for a shorter “race” when it comes to lifting the weight, while the longer superior limbs are preferred in sports such as swimming, field tennis, polo etc. Height is an extremely important criterion in certain sports (basketball, volleyball) and the weight represents, for boxing, the division basis for the trial’s categories. Even within the same sport, the various positions in the field require specific somatic features: at basketball, the fulcrum can have a lower stature, it would be good if the football porter were as tall as possible etc.

Analyzing the literature on the issue of sports selection, we may mention that the increased demands made by performance sports provide for the participation of athletes endowed with the following factors: constitutional genetic factors, endocrine factors, metabolic and nutritional factors, somatic factors, motricity and technical, tactical, psychological training.

These factors can be correctly appreciated only through a tight partnership physician-coach-physical trainer and through a good knowledge of the scientific evaluation criteria. It begins with a general detailed anamnesis, to which it is added the medical and sportive anamnesis, which will be not only initial, but also periodical. It continues with the somatometric examination which will comprise the clinical examination, the antropometrical examination and the somatometrical examination. The somatometric examination and that through which the appreciation of the individual physical qualities is being done come to complete the medical and sportive evaluation in order to carry on a complete and, at the same time, complex, evaluation of the medical and sportive evaluation in order to reach the final goal of medical and sportive orientation based upon scientific criteria of the individual and based upon obtaining the sportive performances at the highest levels.

However, the child’s genetic potential remains the main selection source. This presupposes an ample action of conceptual and organizing nature of the evaluation of various planes (anamnesis, diagnostics of the health state, level of physical and functioning developing and development, psychic availability etc.) of some big communities of children and juniors. In order for the selection to take place, there must exist a model and a personalised or standardised system.

The model represents an organising framework of indicators and criteria, which decide the selection of those endowed for a specific type of sportive effort. The system is made up of a number of criteria, their structure, the succession of application and the measuring procedures

generated from the subjects' testing. „Performance sports activity is becoming a strong educational factor that is geared both towards physical, moral and aesthetic improvement” [3].

3. Argument of the paper

This paper brings to the attention of those in law, the importance of the two selection criteria (anthropologic and genetic), the only ones that can scientifically anticipate the evolution of the future sporting performance and the extent to which it will become the optimal anthropological type for the sporting branch in which it was selected. Depending on these criteria, those who make the act of selection can direct the young athletes towards the sport that fits them anthropologically.

The knowledge of the hereditary background can be carried on only through selection (not only in children, but also in adults) carried on anthropologic and genetic basis. The methodology of these disciplines objectify to a high degree the selection methods which become truly scientific and which are achieved during some stages (procedures, methods):

a) The bio-chemical analysis of the constitutional type supplies special information:

- potential speed for producing the insulin, an important factor in the sportive productivity, it varies in very large limits, from 10 to 40 %;
- with resonance in the efficiency of the sportive training it is presented the iodine concentration (2,5-11,5%), the variations of the plasmatic catalyse, serumal lipase, carbon anhydrase and other;
- knowing some individualities – the endocrine constitutional type – are an overwhelming importance for achieving a maximum productivity during the sportive training.

The endocrine type thus determined, based on the establishment of the domination and sub-domination of the endocrine gland, correlates with the morphologic type, establishing the individual effort dosing norms in correlation to the requirements of the various sports branches and trials for the achieving of top performances;

The sportsmen who have a hyper-thyroidal profile are compatible with speed efforts; the android profile is compatible with the force efforts (heavy athletics, throwing); the hyper-hypophyseal (gigantic type) is ideal for the sportive games (basketball), and the hyper-cortical-upper-renal profile is favourable to the long-term efforts, resistance (athletism). „Physical education is a multidisciplinary science, being a border area between the biological and social sciences, it shows the close relationship of partial

dependency between anatomy, biology, physiology, anthropology, sociology and psychology” [4].

The constitutional type results not only from the selection based on the inherited variables, but also from the training process. The structure of the means used, the methodology applied determines the profiles, bio-types, distinct models in gymnastics, weights, fights, judo, swimming.

„In order to achieve a high level of performance without engaging in a trial-based learning process, until the correct method is known, it is necessary to understand the fundamental elements related to the sport” [5].

b) The kariogram is the emphasis using the microscope or the marked thymidine of the 46 de chromosomes (particles of substance from the cell’s nucleus). The female, as well as male body, possesses not only androgen – masculine – but also oestrogen – feminine – hormones, only the proportion varying at the two sexes. It is easily understood the advantage of the type for the performance sport (at females, a higher masculinity rate). This method allows the prognosis in proportion of 90 % of the masculinity or femininity rate even before the anti-puberty stage, it being especially useful in the selection of sportsmen.

In some athleticism trials, the sportswomen with a higher rate of masculinity achieve a higher level of performance. In gymnastics, the girls; girls with an accentuated feminine somato-sexual typology cannot be selected because their performances would be compromised.

c) The family report, correlated with the somato-physiological features of the individual. The investigation of the family tree aims the somatic, motive and psychic qualities at the ancestors’ level (parents, grand-parents) and the collateral relatives (brothers, sisters etc.).

The results obtained in the sphere of the genetic determination of some of the features of importance for the sportive activity is due to the numerous research carried on through various methods. Regarding the somato-functional type and its hereditary determination, a series of data was obtained through various genetic methods (the twin methods, that of the parents and children correspondence, that of the family tree etc.).

Among the main somatic features are included also those which characterise the musculoskeletal system, more powerfully generically conditioned than the fatty tissue. The correlation and inheritance are higher in this case for the bone tissue than the muscular one, and the correlation coefficients of these two tissues are higher compared to the those of the fatty tissue. Without a doubt, the essential features cannot be changed with the help of the physical exercise, in order to obtain changes due exclusively to a sportive success.

„Increased muscle strength is obtained after a long training; in a first step, these values decrease, fact which is explained by relaxed, non-forceful muscle work.”[6]

The morphological parameters are represented by the height of the body, the dimensional span of various body segments, their proportions and shape, weight, chemical tissue composition – of which, especially, interests the active body mass, the muscular mass, the quantity of free and inter-cellular water, the histological and histochemical structure of the visceral fibre – elements which define the somatic constitutional type and which influences the increase of the sportive performance.

In this case it is necessary the selection of the individuals with mass, height and body proportion corresponding to the ideal constitutional type for a certain sportive discipline or trial.

The length of the body and of its limbs, the body weight, the width of the basin and hips, the girth of the waist, chest, buttocks, shoulders, as well as the fat deposits in various body parts proved to be hereditary dependent.

From this research department, the data regarding the body structure constitutes the most important aspect for the selection and the sportive orientation of the children.

Lately, it was established that the „human active mass”- MAC) is a new parameter of the functional capacities of the human body. MAC correlates well with the VO_2 max., the muscular force, resisting and other movement capacities. The differences among the individuals with regard to the body structure manifest themselves as a consequence of the interaction between the physical activity, food and, as research showed, genetic factors. Health and weaknesses are lack of prerequisites for normal growth and harmonious development for the good conduct and coordination of physical, organic and psychological functions "[7].

The percentage of fatty tissue for the performance sportsmen vary in large degrees, according to the sports and it is between 6 and 13 % (19 % for the throwers and upper-weight categories) in men and between 12 and 19 % in women. The changes in weight and body composition in sportsmen is correlated with the training condition, period and energy contribution. Some studies have shown that the percentage of fatty tissue is inversely proportional to the aerobe maximum capacity and with the performance during long-distance running, and the level of active mass is correlated with the performance in the sports which require the maximal force.

The body height and the proportions of its segments are, to a large degree, hereditary determined. The body height is one of the most anthropometric representative feature. Many studies regarding its genetic

determination were dedicated to the estimation of the correlation coefficients between the parents' body height and that of the descendants, between the descendants of various age and the ancestors of various degrees. Studies demonstrate that these correlation coefficients between the descendants and ascendants are highly variable, depending upon the age and sex of the children, as well as the financial status of the population.

And international team of researchers has identified almost 700 genetic variations which play a certain role in determine a person's height and this discovery could contribute to preventing certain maladies associated with the growth process.

Almost 450 American, European and Australian experts, gathered under the umbrella of the Consortium GIANT (International Genetic Investigation of Anthropometric Traits) have made this discovery by examining the DNA of more than 250.000 European individuals, according to a study published in the "Nature Genetics" British science journal.

They have identified 697 genetic variations in more than 400 regions of the genome involved in determining the height – three times more than those known so far. „From now onwards, we can explain approximately 20 % of the hereditary factors which determine height, compared to 12 % as we could in the past", Tonu Eskio declared, a physician at the Boston Children's Hospital, one of the authors of the study [8].

It is considered that between the height of the children and that of the parents there is an (average) correlation of $r = 0,5$. This positive correlation must not be made absolute, but it must be interpreted as a tendency.

d) The study of the twins is a method of great value with regard to the evolution of the morphological features of the monozygotic twins compared to the dizygotic ones.

Through comparative analysis of a feature at the monozygotic and dizygotic twins it can be traced a coincidence or lack of it which can be associated with the weight of the genetic and environmental factors in the manifestation of the phenotype. The monozygotic twins (GMZ) come from the same zygote and, thus, are genetically identical. Usually, GMZ, having an identical genotype, have similar hereditary features (coincidence) and differ only in terms of features influenced by the environment (discordant).

Another façade of the bio-type is constituted by the idea that not only the morphological parameters, but also the physiological ones have a good degree of genetic conditioning. That is why, upon the establishment of their value and importance in determining the performance sports it is imposed to know also the level of this genetic conditioning. We consider useful such a specification, if we do not forget that selection in sports, being

done at an early age, claims the establishment of a constitutional typology based on age groups, based on the selection stage. Specifying the way in which the sportsman will become or not the constitutional, anthropometrical optimal type for the branch or trial for which he/she trains is crucial. „The selection is a process carried out until the upper limits of performance” [9].

4. Arguments to support the thesis

Through this paper I would like to highlight the very low number of teachers and coaches that take into account the scientific selection criteria, the existence of morpho-functional parameters and genetic determinants (height, range, speed, coordination capacity) that can be developed less by training. The indices provided by sport anthropology are particularly important for the selection of those youngsters who best overlap the ideal constitutional biotype of the performer in the sporting industry. Practice has shown that it is not enough to have only a well-established theoretical concept about the content of the selection act. To organize and direct the complex process of selection means to set precise and clear objectives, to properly instruct all those with tasks in the field of selection, on its various stages, to periodically analyze the effectiveness of this activity, to establish new, appropriate measures for continuous improvement of the selection activity.

Selection needs organisation, specialists and inventory (equipment, reactive). Based upon the data provided by research, from the investigation of some elite sportsmen in the international arena it was able to establish some values of the indicators for the physiological and bio-chemical indicators. „Lately the pace of approvals of new world records is kind of low and it is expected that in future „the answer” do not come in „technical” or „training”, but from a „selection” biotype” [10].

The comparison, association or reporting of the values obtained through the application of the anthropometric and functional examination between them has as a result the establishment of some anthropometrical and physiological indexes, which express a series of complex features of the human body. Some of the most important indexes for the appreciation of growth and development are: The Broca index, the Bruschi index, the proportionality – Adrian Ionescu - index, the thoracic – Erismann - index, the Amar index, the force index etc.

5. Conclusions

Acknowledging the importance of achieving selection using anthropological and genetic basis, by applying the information enlisted above, creates the favourable framework for beginning a sportive activity which has as finality achieving performance. Knowing these criteria represents the premise of selection and adequate training of the sportsman placed at the age of the great biological availability and of the full motivation for high performance during the sports trial or branch for which he/she opted or was selected.

„Selection needs to stimulate the preoccupation of coaches, physical education professors, physicians and researchers for the promotion in the performance section and in the representative lots of some of the sportsmen with certain long-term possibilities, capable of obtaining in the shortest time superior performances and can maintain them for a prolonged time” [11].

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